THE EFFECTS OF SELF-RECORDING UPON NONVERBAL REASONING PERFORMANCE FOR ELEMENTARY SCHOOL STUDENTS

By

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For Philip Rubin,

whose implacable drive and courage made

me very proud to be his daughter

Ich hub dich lieb

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KEY TO ABBREVIATIONS

C - Control

SBC - Standard Behavior Chart

RSR - Raw Score Record

WISC-R - Wechsler Intelligence Scale for Children - Revised

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THE EFFECTS OF SELF-RECORDING UPON NONVERBAL REASONING PERFORMANCE FOR ELEMENTARY SCHOOL STUDENTS

By

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The purpose of this study was to investigate the effects of two different forms of feedback upon nonverbal reasoning performance as measured on the Coding Subtest of the Wechsler Intelligence Scale for Children-Revised (WISC-R). In an attempt to expand upon the existing knowledge in this area, this study dealt with two specific methods of self-recording.

The first type of self-recording method used in this study was the Standard Behavior Chart. The inherent structure of this chart eliminates the excessive time and complication usually associated with other traditional recording techniques. In the past, this chart has been used concurrently with various modification programs in order to bring about successful changes in behavior. This particular research study focused upon the chart as a means of modifying behavior without any additional modification program. The second method

of self-recording involved the simple task of recording raw scores on a sheet designed for that purpose.

The students selected for this study were chosen from a population of fourth and fifth graders. A table of random numbers was applied to the fourth and fifth grade rosters in order to select the sample. The sample was comprised of thirty students and included fourteen females and sixteen males. Eighteen students were fifth graders and twelve were fourth graders. The mean age for all students was ten years and three months.

The sample of students was randomly assigned to each of three experimental treatment groups resulting in an equal number of students in each treatment level. Each student received only one experimental treatment level. In addition, there was random assignment of experimental treatment levels to each group resulting in a completely randomized design.

The subjects in this study performed on the Coding Subtest of the WISC-R for a total of fourteen data sessions. During the administration of this task, the examiner allowed for a two minute timed sample in which the subjects marked empty boxes with appropriate symbols. The administrator of the task recorded the correct and incorrect responses and awarded one point for each item marked correctly. Two of the experimental treatment groups received immediate feedback as to their performance on the task. This feedback was considered to be ancillary to the typical feedback which

is afforded by viewing one's progress on the test. These two groups recorded their scores for the day according to the particular procedural treatment assigned to that group. A third group acted as a control group and received no formal feedback except for that feedback which naturally consequates performance, such as the visual inspection of the finished task. At the completion of the experiment, questionnaires were distributed to each student. This questionnaire was constructed so as to elicit brief subjective opinions from the students concerning their perceptions of the study.

Results showed significant treatment effects ($\underline{p} < .05$) with a significant treatment difference between the Standard Behavior Chart and Control groups. Individual data analyses were done to clarify trends and to focus upon individual productivity and celeration measures for both speed and accuracy pertaining to three different subjects. The superiority of the treatment intervention was observable in these data and in the data of the individual subjects.

In addition to extending the existing knowledge in this area, this research may have significance in that it suggests new procedures for curriculum and behavior management in classroom situations. It demonstrates that charting itself is a reactive process and may serve to accelerate or decelerate the behavior charted. Thus, teachers and other professionals could utilize this knowledge and plan interventions which use the potential power of charted feedback instead of other extrinsic reinforcers.

CHAPTER I

INTRODUCTION

One of the most important contributions to the science of human behavior has been the proliferation of knowledge concerning the reactive nature of various forms of feedback (Geis & Chapman, 1971). Of these various forms, student self-recording exists as one particular type of reactive feedback with significance to the classroom teacher. There have been many traditional types of self-recording found in classroom environments which have consumed more teacher and student time than is warranted. This expenditure of time has resulted in a teacher reluctance to use innovative feedback procedures.

However, some innovative types of feedback have been introduced into classroom use with recognized and favorable results. One such self-recording device, a behavioral graph, has been found valuable when used in conjunction with behavior analysis techniques (Bolstad & Johnson, 1972; Duncan, 1971; Houton & Sullivan, 1975; Knapczyk & Livingston, 1973; La Croix, 1973; Mahoney, 1971; McFall, 1970; McKenzie & Rushall, 1974; Robertshaw, Kelly, & Hiebert, 1973; Zimmerman, 1975). Favorable results have also been obtained in some studies dealing with this self-recording device without any concurrent modification procedures (Berger, 1972; Kazlo, 1976).

Although significant results have been reported in the self-recording literature with respect to reactivity, additional research which specifically utilizes different types of self-recording techniques is needed. The purpose of this research study is to introduce two methods of self-recording in an academic environment which are considerably different from the methods used in previous studies. One method involves recording on a Standard Behavior Chart; the other method is concerned with recording raw scores on a form designed for that purpose. These two methods will be analyzed on their own merit without any concurrent modification procedures. A third method which does not utilize any systematic self-recording device will be compared to the first two methods discussed above.

The rationale for this study as it relates to the forms of feedback mentioned above can be explained best by considering the relationships among the areas of knowledge of results, precision teaching, self-recording, and reinforcement theory. Knowledge of results represents the concept of feedback and is defined as all forms of feedback given to an individual. Many researchers have concentrated their studies in this particular area, as reviewed by Locke, Cartledge, and Koeppel (1968):

> The facilitative effect of knowledge of results (KR) upon learning and performance is one of the best established findings in the research literature. (p. 474)

As seen in Figure 1, precision teaching represents the operations by which feedback is carried out. It involves the daily recording of frequencies of performance, analyzing individual data, and making appropriate changes in the environment as indicated by the data collected. Alper and White (1971) described precision teaching in the following way:

> First developed by Lindsley (1964) at the University of Kansas, [precision teaching] is an adaptation of the principles derived by Skinner (1953) in operant technology. [It is a] self-examining, self-evaluating, and self-correcting analytic paradigm which [has] been demonstrated through countless basic and applied research projects to be both [an] effective and easily implemented method for the development and improvement of almost any behavior. (p. 445)

The particular component of precision teaching elaborated upon in this study is the area of self-recording (see Figure 1). Self-recording can function as a reinforcer, punisher, or discriminative stimulus. Further explication of these terms is presented in Table 1.

The first function that self-recording may serve is that of a reinforcer. As indicated in Tables 1 and 2, reinforcement may be defined as the application of a positive stimulus or the withdrawal of an aversive stimulus with a resultant increase in the frequency of the behavior being measured. In this case, self-recording may function as a reinforcer by acting as a positive stimulus which follows

Figure 1

METHODOLOGICAL STRUCTURE

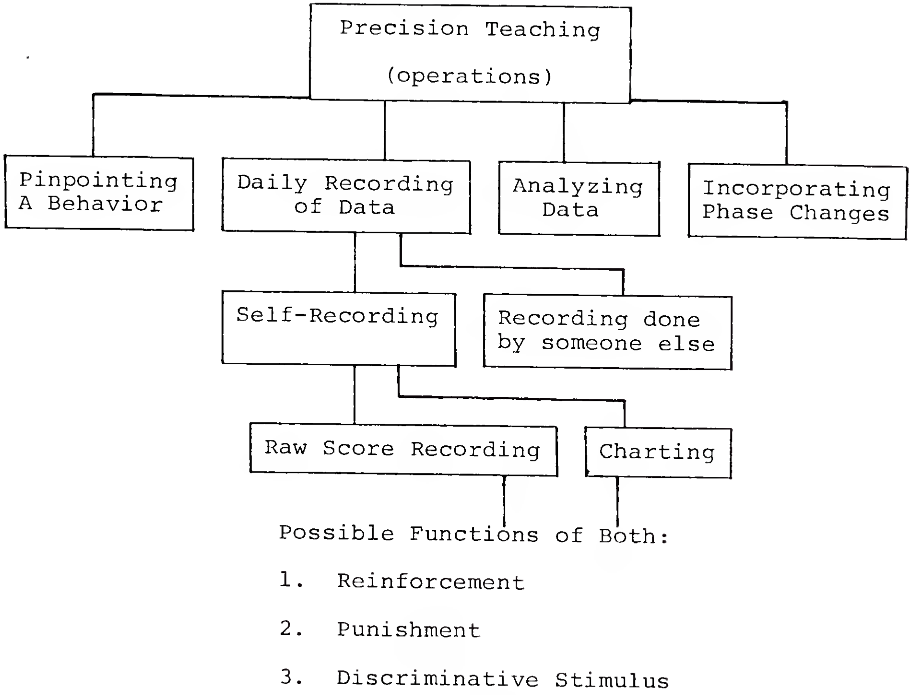

Table 1

DEFINITION OF TERMS

Term	Definition
Reinforcement	There are two types of reinforcement: positive reinforcement and negative reinforcement. Positive reinforcement refers to the presentation of a positive stimulus whereas negative reinforcement refers to the withdrawal of an aversive stimulus. Both increase the frequency of the behavior they follow.
Punishment	Punishment represents the application of an aversive stimulus or the withdrawal of a positive stimulus resulting in a deceleration of the frequency of the behavior it follows.
Discriminative Stimulus	Discriminative Stimulus refers to the particular stimulus which is consistently present when responses are reinforced.

Table 2

REINFORCEMENT AND PUNISHMENT PARADIGM

APPLY	Positive Stimulus	Result: Positive Reinforcement
	Aversive Stimulus	Result: Punishment
WITHDRAW	Positive Stimulus	Result: Punishment
	Aversive Stimulus	Result: Negative Reinforcement

the behavior being measured, and results in an increase in that behavior (see Figure 1).

Another function that self-recording serves is that of a punisher (see Figure 1). As noted in Tables 1 and 2, the application of an aversive stimulus and the withdrawal of a positive stimulus are both defined as punishment. Self-recording can act as a decelerator or punisher upon behavior if the stimuli associated with the self-recording response are aversive (La Croix, 1973; Strong, Sulzacher, & Kirkpatrick, 1974). It is this reactivity of the self-recording response, acting as a reinforcer or a punisher, that is reviewed in this study.

The third function of self-recording may be labeled as a discriminative stimulus (see Table 1 and Figure 1). Knowledge alone of the stimuli that signal certain performances may alter that performance. In this example, self-recording can act as a cue or signal of various behaviors to be measured and modified. Although this function of self-recording remains a logical possibility, the key feature of this study will center upon the punishing and reinforcing aspects of self-recording.

Statement of Intent

Self-recording, considered to be one aspect of precision teaching, will be the method of feedback that will receive primary attention in this research project. Two separate applications of self-recording techniques have been chosen in an attempt to provide simple feedback measures operating within a classroom environment.

The first method of self-recording to be studied involves the Standard Behavior Chart. This chart constitutes the basis upon which the precision teaching framework is designed. The structure of this chart allows for the elimination of the excessive time and complication usually associated with traditional recording techniques. Similarly, this system of measurement affords an advantage in that it can help teachers to evaluate pupil performance with both efficiency and economy (Gaasholt, 1974).

The other method of self-recording to be researched involves the simple task of a student writing down his or her raw scores obtained during academic sessions with the experimenter. The student will daily record these scores on a Raw Score Record sheet enabling him or her to observe the raw scores obtained from previous performances.

It is the writer's general hypothesis that both the mere recording of raw scores and self-recording on the Standard Behavior Chart will in themselves improve performance. It is also hypothesized that a differential effect between the two treatments will emerge.

To test this hypothesis, the following research questions have been developed: Does self-recording of performance contribute to an increase or decrease in the performance of that task? Additionally, if there is an increase or decrease in performance, is this directly attributed to the charting techniques employed and/or to the direct recording of each student's raw scores?

CHAPTER II

REVIEW OF THE LITERATURE

The purpose of this chapter will be to examine the literature which is of particular relevance to this study. The chapter is divided among many sections so as to clarify the material reviewed. These subsections include: precision teaching; the reactivity of self-recording; self-management in the school environment, including management approaches using self-recording with and without additional contingencies; self-management in the clinical environment; and the knowledge of results. Finally, a brief compendium of all topics reviewed will appear at the end of this chapter.

Precision Teaching

There is an abundance of information concerning precision teaching and self-recording in an educational setting. When considering evaluation systems for teachers, especially those systems which involve self-recording, emphasis may be placed upon precision teaching techniques as suggested by many experimenters (Gardner, 1974; MacMillan, 1973; White & Haring, 1976).

A few quotes from the work of Lindsley (1972), a well-known researcher of precision teaching, will suffice to facilitate a brief understanding of the background and evolution of precision teaching as it relates to this study.

The use of precision teaching for teachers as it builds upon operant conditioning techniques is described by Lindsley (1974) in the following way:

> Precision teaching uses the management procedures that operant conditioning originally used but relies more on traditional change procedures that teachers and students invent and select. . . .Precision teaching involves daily recording of the frequencies of different classroom performances on a standard chart. This permits teachers and students to project the outcome of procedures they are using. Standard charts facilitate sharing data. (p. 388)

Daily recording of frequencies of performance, as Lindsley stated, involves counting the number of instances a behavior is emitted and then dividing that number by the time involved in emitting the behavior. This procedure is very practical and it also allows the teacher to encourage his or her students to share their data via charting techniques.

Other researchers have emphasized the practicality of precision techniques in the management of child behaviors. Gaasholt (1974) stated five basic components of the precision teaching paradigm. They are

1. Pinpointing a pupil behavior.
2. Recording this behavior daily, computing the rate (numbers of responses over elapsed time), and charting it on a 6 cycle behavior chart.
3. Recording teacher behavior in relation to pupil behavior.
4. Analyzing data to decide what changes in teacher performance might affect pupil performance, if a pupil performance rate needs to be changed.

> 5. Making only one change in teacher performance at a time and then re-evaluating. (p. 129)

When carefully implemented, this analytical paradigm affords one in the educational profession a broad range of applicable methods for the improvement of behaviors.

Different Types of Standard Behavior Charts

The standard charts referred to in the preceding quotes have taken many forms. In addition to Lindsley's (1974) six-cycle behavior chart, which is based upon a ratio scale, a standard chart using an arithmetic scale has been developed by Wolking (1976) (see Figure 2). This chart allows one to continuously record daily measurement on an arithmetic frequency scale. Inspection of Figure 2 reveals two different graphed areas on the chart. The area labeled "speed" pinpoints the behavior movement as the total number of defined behaviors per minute. The area labeled "accuracy" is defined as percent correct (Wolking & Hodgson, 1976). The distinctions apparent between these two measurements permit one to analyze the movement cycle in great detail (Wolking, 1976). An additional finding as accomplished by the research of Wolking and Hodgson (1976) concerns linear regression lines and their fit to frequency dots on six-cycle, semi-log behavior charts and arithmetic charts. A review of their findings indicates a better linear fit for the arithmetic charts as compared to the semi-log charts (Wolking & Hodgson, 1976) (see Table 3).

Figure 2

THE STANDARD BEHAVIOR CHART

Reproduced by
Permission of
W. D. Wolking, 1976.

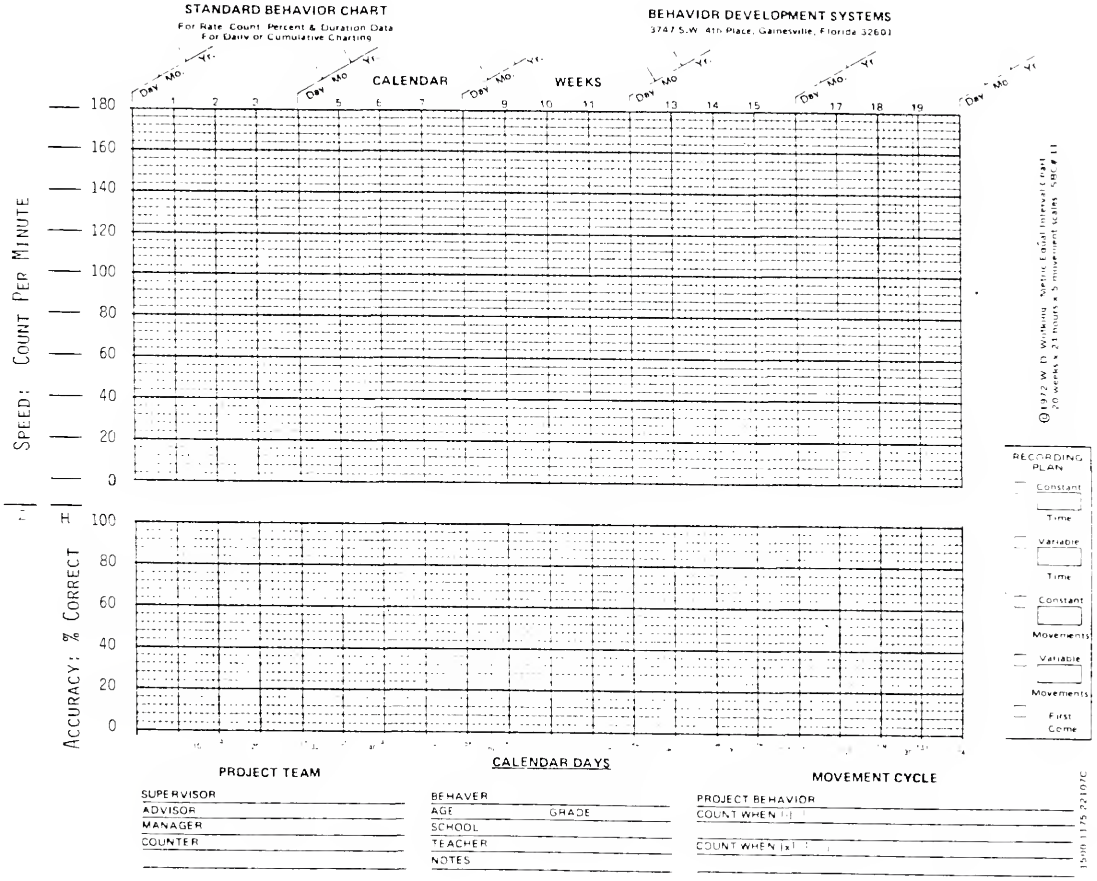
STANDARD BEHAVIOR CHART
For Rate Count Percent & Duration Data
For Daily or Cumulative Charting
BEHAVIOR DEVELOPMENT SYSTEMS
3747 S.W. 4th Place, Gainesville, Florida 32601
CALENDAR
WEEKS
Day
Mo.
Yr.
1
2
3
5
6
7
9
10
11
13
14
15
17
18
19
SPEED: COUNT PER MINUTE
180
160
140
120
100
80
60
40
20
0
ACCURACY: % CORRECT
100
80
60
40
20
0
CALENDAR DAYS
©1972 W. D. Wolking Metric Equal Interval Chart
20 weeks x 21 hours x 5 movement scales SBC# 11
RECORDING PLAN
Constant
Time
Variable
Time
Constant
Movements
Variable
Movements
First
Come
PROJECT TEAM
SUPERVISOR
ADVISOR
MANAGER
COUNTER
BEHAVER
AGE
GRADE
SCHOOL
TEACHER
NOTES
MOVEMENT CYCLE
PROJECT BEHAVIOR
COUNT WHEN
COUNT WHEN
1500 1175 221070

Table 3

LINEAR REGRESSION LINES AND THEIR FIT PERTAINING TO STANDARD BEHAVIOR CHARTS

Type of Standard Behavior Chart	Percentage of the total cases that had a line of better fit
Arithmetic	61
Six-Cycle Semi-Log	39

Note. There was a total of 140 cases.

Although it has been established that self-recording within the precision teaching paradigm allows one to use direct measures in the classroom (Starlin, 1971), teachers are concerned about the inconvenience associated with teaching children to chart. Starlin (1972) demonstrated a facility with which children can be taught to chart their own behaviors. She found that "self-charting permits students to exercise more responsibility and control over their own learning" (p. 139). A study involving precision teaching of visually impaired students, as cited by Douglass and Mangold (1975), further endorses the ease of learning and use of the chart. Subjects were taught to daily record their behavior on Braille graphs which use an arithmetic scale. Additionally, Wolking and Hodgson (1976) emphasized that the teachers and supervisors in their study almost unanimously endorsed the arithmetic chart that they were instructed to use. Evidence of this endorsement was expressed in a questionnaire that was answered by teachers using this chart.

The Reactivity of Self-Recording

Before discussing the literature relevant to self-recording in both school and clinical environments, an explanation of the reactivity of self-recording is essential so as to demonstrate the basic premise upon which many of the relevant research studies were based.

Nelson, Lipinski, and Black (1975) defined self-recording as a reactive process by stating that "self-recorders' behavior changes as a function of self-recording" (p. 337). Other researchers also acknowledge the reactivity of monitoring one's own behavior (Frederiksen, Epstein, & Kosevsky, 1975; Kazdin, 1974; Lipinski & Nelson, 1974; Orne, 1970). It has also been shown that the reactive nature of self-recording has usually resulted in beneficial behavioral changes (Lipinski & Nelson, 1974). A more detailed analysis of the studies which addressed themselves to specific environments in which self-recording was reactive follows.

Self-Management in the School Environment

Research on the use of the Standard Behavior Chart and other self-recording techniques, when used within the school environment, has been commented upon by several experimenters (Berger, 1972; Broden, Hall, & Mitts, 1971; Johnson, 1971; Johnson & White, 1971). Many of these researchers have conducted studies involving the concomitant use of self-recording with other modification techniques. Several others have used self-recording without any added contingencies. For this reason, this portion of the review of the literature will be subdivided into categories involving independent self-recording and concurrent self-recording. It may also be noted that many of the self-recording techniques to be discussed involve a variety of configurations, as exemplified by charts, wrist counters, index cards, and paper slips.

Self-recording without concurrent modification procedures

As discussed above, many research studies which have dealt with charting or other self-recording devices point out that, when used to merely self-record, the chart serves to modify the pinpointed behavior in question. A research study completed by Berger (1972) involved self-counting and also explored the Standard Behavior Chart as a self-recording device to monitor school-related behaviors. This was done without the use of any concurrent modification procedures. Berger (1972) found that seventy-eight percent of all examined behaviors changed in the desired direction. This suggests that self-counting and charting may lead to successful management of one's school environment.

Further evidence of the importance of self-monitoring is provided by a study by Kazlo (1976), in which the effects of self-monitoring were measured by observing study behavior. Kazlo (1976) had students in an experimental group daily record the number of study questions they answered. At the same time, students in a control group were not instructed to self-record their behavior. Results indicated that the self-monitoring group wrote a significantly greater number of answers to questions than the control group.

A similar study was conducted by Johnson and White (1971). Undergraduate students were asked to observe and record their studying behavior for one of their college courses. An analysis of the results demonstrated that the experimental group achieved better grades than the control group. These findings further solidify the hypothesis that self-recording procedures are reactive and may be successfully used as a vehicle by which behavior change takes place in a school setting.

The therapeutic effects of self-management within the classroom were also tested in a study involving "potential high school dropouts" (Gottman & McFall, 1972). Subjects were given pink and green index cards and told to record any instance of oral participation in class. There was an increase in the self-monitored response of oral participation, which accentuates the potentially therapeutic aspects of the reactivity of self-recording.

In another investigation of the effects of self-recording upon classroom behavior, Broden, Hall, and Mitts (1971) found that self-monitoring brought about an increase in the pinpointed behavior being emitted. In their first experiment, Broden et al. modified the studying behavior of an eighth-grade girl. Paper slips were provided so that the girl could record whether or not she studied in history class. The procedure resulted in an increase in the studying behavior of the student. Interestingly enough, studying behavior decreased when the slips were withdrawn. In the second experiment, number of talk-outs emitted by an eighth-grade boy were recorded on paper slips. Results showed that talk-outs decreased when self-recording was in effect.

A research study conducted by Johnson (1971) employed the Standard Behavior Chart as a method of helping two students learn. In order to increase correct math responses in one of the first grade students, correct and incorrect responses to addition combinations were directly recorded. Results showed that the student's math progress increased substantially over a period of one month using this technique. In describing one of her students, Johnson (1971) stated:

> Charting also acted as a motivator, and as she progressed and increased her performance she gained more self-confidence . . . . It provides the continuous records which make it possible to individualize instruction, to motivate students, and to help teachers evaluate their own teaching effects. (p. 110)

This finding combines with the others mentioned to suggest the reactive process of independent self-recording.

Concurrent self-recording

Self-recording when used contemporaneously with other modification procedures has shown to be effective in producing behavior changes. The following studies exemplify patterns of the reactivity of self-recording.

A study done by Bolstad and Johnson (1972) focused on modifying the disruptive behavior of four elementary school children. Two of the three experimental subjects were instructed to observe their own behavior. Additionally, they were allowed to control the dispensation of reinforcers to themselves based on their self-collected data. Other subjects received reinforcement on an externally managed basis. The results of this study demonstrated that the self-regulation procedures were slightly more effective than the externally managed procedures. Although additional contingencies such as specific reinforcement were added to the study, the practicality and power that self-recording may wield is evident.

Another study utilizing behavior management and self-recording addressed itself to the effects of cueing on the rate of teacher praise given to students (Houten & Sullivan, 1975). Two teachers were instructed to count and graph their daily praise rate. In a second phase of the experiment, all teachers received auditory cues so that teacher praise might be prompted. Results showed that self-recording elevated behavior minimally and that cueing can work in environments where self-recording is not effective. It is also conceivable that the cueing in this experiment acted as a potent discriminative stimulus which signalled the attention of the teachers.

In an attempt to increase the reading performance of thirteen special education students, Knapczyk and Livingston (1973) used self-recording and a token reinforcement system as one of their experimental conditions. Each individual was presented with a work record book in which he or she entered his or her correct responses to a reading assignment. An additional contingency was added which consisted of earning a particular amount of money based upon one's reading performance. Knapczyk and Livingston (1973) found a statistically significant difference ($\underline{p} < .05$) between baseline performance and the self-recording and token phase resulting in an increase in the accuracy with which students responded to their reading assignments.

Glynn and Thomas (1974) used a combination of behavioral self-control procedures to modify on-task behavior of elementray school students. Although self-recording was only one component of the project, Glynn and Thomas (1974) stated the advantages of their behavior specification chart in the following way:

> However, reports from all observers indicated that the chart eliminated much of the indecision and confusion that subjects had about assessing their behavior. The chart could have functioned as a discriminative stimulus. (p. 305)

Finally, with regard to specific interventions in which self-monitoring may be used as a reinforcer, Clement (1973) stated, "Observing and systematically counting each occurrence of the behavior is . . . [another method] of modification" (p. 617). Taking this one step further, Bandura and Perloff (1973) stated that ". . . self-monitored reinforcement possesses considerable behavior maintenance value" (p. 615). These statements provide substantial support for the contention that the direct counting and recording of raw scores is a potent reinforcer. As was noted earlier, self-monitored reinforcement in the form of the arithmetic Standard Behavior Chart and students' direct recording of raw scores will serve as the focal point for this study.

Self Management in the Clinical Environment

An abundance of literature relating to self-management is available to those considering studies within a clinical milieu. These studies are not conducted within the school environment and usually have a small sample size. A selected number of studies will be reviewed to explicate the concept of the reactivity of self-recording. These studies employ self-recording along with other interventions and address themselves to behaviors within the clinical areas of obsessional thoughts, obesity, stuttering, smoking, grimacing, and verbal behavior. Regarding the reactivity of self-recording techniques used within a clinical setting, McFall (1970) stated:

> The Ss in behavior modification research are sometimes required to monitor and record their own behavior. Such self-monitoring may be producing its own behavior changes. (p. 135)

The subjects in the study conducted by McFall (1970) self-monitored the frequency of their smoking and non-smoking behavior. An analysis of the results indicates that smoking-related behaviors changed in the desired direction when the self-monitoring phase of the experiment was in effect.

An interesting study representing an application of self-management techniques in the modification of covert behaviors was done by Mahoney (1971). The client in the study was a twenty-two-year-old male complaining of uncontrollable obsessional ruminations about being brain damaged. The client was told to daily record when he engaged in these obsessional thoughts. An additional intervention was added whereby punishment was made contingent upon the emission of these thoughts. A combination of these two techniques resulted in a substantial decline in the frequency of these undesirable thoughts.

A research study by Duncan (1971) utilized the Standard Behavior Chart as a self-recording device with a three-and-a-half-year-old girl. Duncan had the child count and record her selfish acts and thoughts (labeled outer and inner behaviors respectively). At one point in the experiment, contingencies were added to decrease the occurrence of these undesirable behaviors. This phase was then followed by the institution of a "recording only" phase. Results conclusively showed that the mere counting and recording of the behavior in question served as a decelerator of that behavior.

In another study involving recording techniques as a reinforcer, Jens and Shores (1969) worked with three trainable mentally retarded adolescents in an effort to accelerate typical workshop tasks. They showed that the use of behavioral graphs served as a controlling influence on the rate of behaviors under study.

A number of researchers have suggested the significance of self-monitoring in the treatment of obesity (Bellack, Rozensky, & Schwartz, 1973; Romanczyk, Tracey, Wilson, & Thorpe, 1973; Stunkard, 1975). Bellack et al. (1973) found that self-monitoring prior to the eating response in obese patients showed a larger reduction in body weight of these patients. Similarly, Romanczyk et al. (1973) demonstrated that self-monitoring of daily caloric intake was an effective method of producing weight loss in obese individuals.

In a study concerning covert behaviors, Zimmerman (1975) instructed three clients to self-record the frequency with which they experienced aversive feelings. A wrist counter was used to facilitate the self-recording process.

Consequences involving self-implosion techniques were made contingent upon the undesirable behaviors. Results suggested that clients can modify covert behaviors using both contingency management techniques and self-recording.

A documented study by Herbert and Baer (1972) involved the use of wrist counters as self-monitoring devices to measure attending behavior. Several mothers of children with deviant behaviors were told to count on the wrist counter the number of episodes of attention given to their children. Episodes of attention increased despite inaccurate parent self-recording. The simple counting of attention episodes was effective in producing changes in both parent and child and for two of the three parents that were instructed to use the self-recording device.

Robertshaw, Kelly, and Hiebert (1973) presented a technique aimed at increasing verbal behavior. The subject involved was instructed to record his verbal behavior. A verification of the subject's recording was accomplished by having an adult check for discrepancies between the subject's self-recording behavior and the recorded behavior completed by a staff member. During the treatment involving self-recording alone, the subject's verbal behavior increased over baseline frequencies.

More recently, McKenzie and Rushall (1974) demonstrated the effects of self-recording on performance and attendance for members of a competitive swimming team. Although this did not take place in a strict clinical environment, the similarities between this study and the ones previously mentioned are obvious. In this experiment, a display board was furnished in which each swimmer indicated his or her attendance record at swimming practice. As expected, absentees, late arrivals, and early departures were considerably reduced (45%, 63%, and 100% respectively). Additionally, work rates in swimmers were elevated by an average of 27% when display boards indicating swimmers' performance were used. The results of both of these experiments definitively show that the public self-recording of one's performance generates an appropriate change of behavior. This serves to further endorse the hypothesis that self-recording is a durable reinforcer.

As in the acceleration of desirable responses, deceleration of undesirable responses may result in an overall improvement of behavior. Data summarizing the deceleration of undesirable behaviors are presented by La Croix (1973) in a study concerning the reduction of stuttering in two clients. A counter was given to the subjects with instructions to depress the counter each time a verbal disfluency was emitted. Results significantly showed the reduction of undesirable behaviors once the treatment condition was instituted. Perhaps, as mentioned earlier, the attention paid to the behavior as afforded by self-recording results in desired changes of the behavior in question.

Finally, another example of deceleration was examined in a study surveying the effects of self-recording coupled with teacher praise related to "grimacing" behavior in students (Strong, Sulzbacher, & Kirkpatrick, 1974). It was clearly demonstrated that the counting techniques used in conjunction with teacher praise were effective in reducing the frequency of grimacing. Emphasis here may be placed upon the positive effect as well as the minimum expenditure of energy needed to self-record one's own behavior.

Knowledge of Results

One last category of consideration in this study is the category dealing with the general reinforcing value of the concept of "knowledge of results." The reader is reminded of the position taken earlier in this report that self-recording used as a data collection technique may be appropriately labeled as the operation by which "knowledge of results" is carried out.

Although many researchers have successfully demonstrated the positive motivational effects of self-recording or "knowledge of results," several issues should be taken into consideration before more research in this area is completed. Among these issues are the controversies involving the automatic assumption that feedback, in this case self-recording, always acts as a reinforcer. Geis and Chapman (1971) warned that feedback techniques particular to any monitoring system cannot be automatically assumed to be reinforcing. Specific factors involving varied schedules and delay of reinforcement can also cause effects contrary to the expected results if knowledge of results were considered to be a reinforcer. Results of a study regarding delay of reinforcement, as cited by Geis and Chapman (1971), conclusively showed that delayed reinforcement has a reduced effect upon the behavior to which it has been made contingent.

Another methodological issue to be carefully considered before assuming the reinforcing value of "knowledge of results" pertains to the reliability with which self-recording is carried out. Self-recording carried out in the absence of reliability estimates can lead to the inaccurate reporting of results, which in turn may affect the knowledge of these results (Simkins, 1971). Other studies which address this issue have discussed the possibility of successfully evaluating and controlling covert behavior changes without first computing reliability measures (Hall, 1971; Herbert & Baer, 1972; Lindsley, 1971; Nelson & McReynolds, 1971). Again, the proper design of an experiment which utilizes self-recording and "knowledge of results" can best be achieved after consideration of these issues.

Summary

Discussion in this chapter has centered on the following areas: precision teaching; the reactivity of self-recording; self-management in the school environment, both independently and concurrently with other modification techniques; and self-management in the clinical environment.

Review of the literature pertaining to precision teaching focused upon the use of the Standard Behavior Chart as a self-recording device. Most of the studies that were mentioned reiterated the benefits and ease of acquisition pertaining to the learning of the self-charting response. Defining reactivity as the process by which measurement techniques alters the behavior one is attending to helped present a foundation upon which studies within school and clinical environments were formulated. In appraising the various studies reviewed, one notes the positive effects of self-recording in many behavioral settings. As McFall (1970) stated:

> Something that has long been suspected by psychologists and laymen alike: When an individual begins paying unusually close attention to one aspect of his behavior, that behavior is likely to change, even though no change may be intended or desired. (p. 140)

Although many of the studies involved self-recording and the concomitant use of other behavioral contingencies, the positive effects of self-recording alone were evident throughout the analyses contained in this chapter.

CHAPTER III

METHODS AND HYPOTHESIS

A presentation of the procedures that were used and hypothesis that was tested will constitute the focus of this chapter. Specifically, the topics to be discussed are: subjects and sampling, instrumentation, procedures, data collection, design, and the major hypothesis.

Methods

Subjects and Sampling

The students selected for this study were chosen from a population of fourth and fifth graders at P. K. Yonge Laboratory School located in Gainesville, Florida. A table of random numbers was applied to the fourth and fifth grade rosters in order to select the sample. The sample was comprised of thirty subjects so as to yield a power of $1-\beta$ (beta) = .49 at the $p < .05$ level of significance (Kirk, 1968) as calculated by utilizing the formula for Φ (phi). Included in this sample were fourteen females and sixteen males. Eighteen students were fifth graders and twelve were fourth graders. The mean age for all students was ten years and three months.

The sample of students was randomly assigned to each of the experimental treatment groups resulting in an equal number of students in each treatment. Each student received only one experimental treatment. In addition, there was random assignment of experimental treatments to each group. It was anticipated that the randomization process utilized would eliminate any demographic biases that might have existed.

Instrumentation

The instrument that was used to assess the nonverbal reasoning performance of the students participating in this study was the Coding Subtest of the Wechsler Intelligence Scale for Children - Revised (WISC-R). During the administration of this task, the examiner allowed for a two minute timed sample in which the subjects marked empty boxes with appropriate symbols. The administrator of the task recorded the correct and incorrect responses and awarded one point for each item marked correctly (Wechsler, 1974). This procedure allows for computation of both speed and accuracy.

The desirability of this instrument is validated by one's review of the statistical procedures used in the development of this test. The WISC-R was standardized on a sample of 2,200 subjects, representative of the United States population of children, ranging from ages six through sixteen years eleven months. The standardized sample for each age was stratified according to variables such as geographic area, urban-rural population, and parental occupation. Additionally, reliability coefficients of the Coding Subtest of the WISC-R have been computed for ages 6 1/2 to 16 1/2 at one year intervals. The reliability coefficients obtained for this test were computed by the test-retest method. The split-half procedure, which was used for other subtests of the WISC-R, was not used for the Coding Subtest. This is because it is a speeded test and the reliability coefficient obtained in this manner would be an inappropriate measure of consistency. Illustration of the reliability for the subtest appears in Table 4 (Wechsler, 1974). The age group labeled as 10 1/2 years closely approximates the one used in this study. The reliability coefficient presented for this age group is $\underline{r}$ = .76 which is considered to be an accurate indicator of reliability for this test.

The advantages of this instrument are further recognized upon reviewing the scaled score equivalents for raw scores that are provided for each subtest of the WISC-R. Futhermore, these scores are categorized by successive four-month intervals (Wechsler, 1974).

Procedures

Prior to the commencement of this experiment, permission to work with these students was granted by the University of Florida's Committee for the Protection of Human Subjects; Dr. Catherine Longstreth, Assistant Director of P. K. Yonge; the two teachers involved; and the parents, as covered by a blanket agreement signed by them when entering their children in this school.

Thirty students chosen from a population of fourth and fifth graders at P. K. Yonge Laboratory School were taken out of their respective classrooms and brought to a common room

Table 4

Reliability Coefficients (r_{11}) of the Tests and IQ Scales, by Age
N = 200 for Each Age Group

Test	Age Group											Average
	6½	7½	8½	9½	10½	11½	12½	13½	14½	15½	16½	r_{11}[a]
Information	.67	.80	.80	.81	.83	.88	.87	.87	.88	.90	.89	.85
Similarities	.87	.85	.79	.79	.79	.81	.84	.79	.81	.74	.83	.81
Arithmetic	.79	.75	.69	.80	.76	.81	.80	.81	.73	.80	.75	.77
Vocabulary	.74	.70	.86	.86	.84	.86	.88	.89	.91	.90	.92	.86
Comprehension	.69	.70	.73	.78	.71	.83	.87	.81	.82	.72	.78	.77
Digit Span	.76	.84	—[b]	—[b]	.71	.75	—[b]	—[b]	.79	.79	—[b]	.78
Picture Completion	.84	.81	.85	.78	.68	.80	.75	.75	.72	.68	.75	.77
Picture Arrangement	.77	.72	.69	.76	.72	.73	.78	.72	.74	.73	.70	.73
Block Design	.80	.82	.85	.80	.86	.89	.86	.86	.84	.85	.90	.85
Object Assembly	.76	.73	.66	.70	.64	.72	.63	.72	.72	.68	.71	.70
Coding	.63	.63	—[b]	—[b]	.76	.79	—[b]	—[b]	.65	.80	—[b]	.72
Mazes	.82	.81	.77	.71	.66	.75	.62	.65	.72	.65	.57	.72
Verbal IQ	.91	.92	.92	.94	.93	.95	.96	.95	.95	.94	.95	.94
Performance IQ	.91	.90	.91	.91	.89	.91	.91	.90	.89	.90	.91	.90
Full Scale IQ	.95	.95	.95	.96	.95	.96	.96	.96	.96	.95	.96	.96

Note.—The reliability coefficients for all tests except Digit Span and Coding are split-half correlations corrected by the Spearman-Brown formula. For Digit Span and Coding, test-retest correlations are presented for six age groups; these coefficients, which are based on samples of about 50 children tested twice (1-month interval), were corrected for the variability of the appropriate norms group.

The coefficients of the IQ Scales were obtained from the formula for the reliability of a composite group of tests (Guilford, 1954, p. 393); the values for the supplementary tests, Digit Span and Mazes, were not included in these computations.

[a] The average r was computed by using Fisher's z transformation.

[b] The best estimate of the reliability coefficient of Digit Span or Coding at an age level where retesting was not done is the value obtained at the adjacent age level; e.g., the .84 obtained for Digit Span at age 7½ is the best guess for age 8½. The single exception is for Coding at age 8½, where the most reasonable estimate is the value obtained at age 10½ — the closest age at which Coding B is given. (Coding A is given below age 8.) These "best estimates" for Coding were used when computing the reliability of Performance IQ and Full Scale IQ at ages 8½, 9½, 12½, 13½, and 16½.

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where the experimenter instructed the subjects on the use of the Standard Behavior Chart (SBC) (Figure 2) and the direct recording of raw scores on the Raw Score Record (RSR) sheet (see Figure 3). Following this initial explanation, students were instructed to attend the experimental sessions daily for a period of three weeks. The basic determinants of the length of the experimental treatment depends upon the stability, sensitivity, and the control of undesirable behavioral processes that were examined during a pilot study completed prior to this research study (Sidman, 1960). Reinforcement was awarded to each student on a variable-interval schedule (VI 2.3 days) so as to insure 100% attendance throughout this experiment. Clarification of the issues involved in computing the variable-interval value can be found in Holland and Skinner (1961). The reinforcements used in this experiment were quarters and thank-you notes for each student. Conditions under this schedule of reinforcement were such that each student received the quarter and thank-you note on an average of every 2.3 days. Table 5 shows the schedule upon which reinforcement was delivered. The delivery of reinforcement occurred immediately after the student presented himself or herself at the testing location, thereby obviating any effects the reinforcement may have had on any subsequent testing performance. During each session, the experimenter gave a timed administration of the Coding Subtest of the WISC-R. After the administration of the test, the experimenter and an assistant graded the tests according to the procedures out-

Figure 3

RAW SCORE RECORD SHEET

RAW SCORE RECORD

NAME____________________

DATE OF BIRTH____________________

AGE____________________

SEX____________________

GRADE____________________

TEACHER'S NAME____________________

APRIL 26	APRIL 27	APRIL 28	APRIL 29	APRIL 30			MAY 3	MAY 4	MAY 5	MAY 6	MAY 7			MAY 10	MAY 11	MAY 12	MAY 13
day 1	day 2	day 3	day 4	day 5			day 8	day 9	day 10	day 11	day 12			day 15	day 16	day 17	day 18
MON.	TUES.	WED.	THURS	FRI.	SAT.	SUN.	MON.	TUES.	WED.	THURS	FRI.	SAT.	SUN.	MON.	TUES.	WED.	THURS

Table 5

SCHEDULE OF REINFORCEMENT
DELIVERED TO ALL STUDENTS

Data Session	Reinforcement delivery	
	Yes	No
1		X
2	X	
3		X
4		X
5	X	
6		X
7	X	
8	X	
9		X
10		X
11	X	
12		X
13		X
14	X	

lined in the section of this report entitled instrumentation. The two experimental treatment groups received immediate feedback as to their performance on the test. This feedback was considered to be ancillary to the typical feedback which is afforded by viewing one's progress on the test. The two groups recorded their scores for the day according to the particular procedural treatment assigned to that group. Elaboration of the treatment phases will be discussed in the design section of this report. There was no feedback given to the control group during this experiment except for that feedback which naturally consequates performance, such as the visual inspection of the finished task. At the completion of the experiment, questionnaires were distributed to each student. This questionnaire was constructed so as to elicit brief subjective opinions from the students concerning their perceptions of the study's particularities.

The Hawthorne Effect would not confound the experimental results since all subjects were operating under this effect and any unwanted variation would be eliminated via the randomization process. Additionally, students at P. K. Yonge Laboratory School have probably been heavily experimented upon and, as a result, have become more resistant to the Hawthorne Effect in experimentation. As expected, the children chosen for this study were naive to the charting procedures employed.

Data Collection

Data collection was accomplished on a daily basis with the use of the Standard Behavior Chart (Wolking, 1976). The experimenter daily recorded on this chart the scores obtained for each individual's performance on the Coding Subtest of the WISC-R. The response unit that comprised the daily score was the number of responses emitted by each individual according to the specified time as described in the WISC-R Manual (Wechsler, 1974). The experimenter then converted these scores into frequency measures appropriate to the Standard Behavior Chart. This was accomplished by dividing the defined movement by the designated time. Throughout the study, speed and performance measures were calculated and compared and, at the end of the experiment, celeration values were obtained for each student's display of dots on the chart. This measure of behavioral change is expressed in terms of the unit of frequency referred to as movements per minute per week (Pennypacker, Koenig, & Lindsley, 1972). To reiterate, the total number of defined behaviors per minute constitutes the speed measure, and the percent of correct behaviors establishes the accuracy measure. Of noteworthy consideration is the celeration measure which provides the primary means by which expression of the amount of behavioral change or improvement has taken place. Concomitantly, a productivity measure was computed and is defined by Wolking and Hodgson (1976) as "the percent of change in the speed and accuracy of a performance during the instructional life [of that performance]" (p. 156).

Design

The intent of this study was to assess the effects of both the Standard Behavior Chart and the direct recording of raw scores on nonverbal reasoning performance. Nonverbal reasoning as measured on the Coding Subtest of the WISC-R was selected as the variable for performance so that outside influences in the school could be controlled. The teachers associated with the particular students would at no time incorporate the administration of the coding test into their daily curriculum.

Since there were three treatment levels, random assignment of subjects designated to receive only one level, and an equal number of students receiving each level, a completely randomized design was used (Kirk, 1968). The three treatment levels consisted of the following groups:

1. A group of ten students which did not keep any record relating to their daily test performance.
2. A group of ten students recording measures on the SBC.
3. A group of ten students recording their daily test performance on the RSR sheet.

The first group served as a control to provide a means of comparison for the two types of feedback techniques employed. It may be noted that the layout of the RSR sheet was intentionally designed to resemble the SBC so as to help facilitate isolation of the individual stimuli specific to each method. Assuming that the layout of the RSR sheet is similar to the SBC, the procedures inherent in finding the day and frequency line, and in plotting a daily score, will be the only conditions which differ from writing a raw score on the RSR sheet.

Table 6 presents a schematic representation of the design used in this experiment. The random assignment of subjects designated to receive one level and an equal number receiving each level are observed under conditions specific to each treatment. Ultimately, this design provided for assessment of the reliability of differences among groups.

Hypothesis

The null hypothesis that was tested in this study is stated as follows: There is no statistically significant difference in nonverbal reasoning performance among students in a control, charting, and raw score group.

Table 6

DESIGN OF THE EXPERIMENT

Treatment conditions		
T_1^a	T_2^b	T_3^c
S_1	S_{11}	S_{21}
S_2	S_{12}	S_{22}
S_3	S_{13}	S_{23}
S_4	S_{14}	S_{24}
S_5	S_{15}	S_{25}
S_6	S_{16}	S_{26}
S_7	S_{17}	S_{27}
S_8	S_{18}	S_{28}
S_9	S_{19}	S_{29}
S_{10}	S_{20}	S_{30}

Note. S = Subject.

[a] T_1 = Control condition.

[b] T_2 = Standard Behavior Chart condition.

[c] T_3 = Raw Score Record condition.

CHAPTER IV

DATA ANALYSES

This chapter will focus upon three major areas of analysis. These areas include an analysis of grouped data, selected individual data, and specific supplementary data.

Analysis of Grouped Data

As mentioned above, the effects of charting and the direct recording of raw scores upon nonverbal reasoning performance were the active variables studied in this experiment. The dependent variable was nonverbal reasoning performance as measured on the Coding Subtest of the WISC-R, and the levels of the independent variable were a control, standard behavior charting, and raw score recording group. This is represented in Table 7. As indicated in this table, average daily gain scores comprise the measure for nonverbal reasoning performance. These scores were arrived at by adding each student's daily gain score and then dividing by the total number of gains.

Several issues were considered before choosing the average daily gain scores as the dependent variable. There was no reason to suspect that the initial performance for each subject was in any way related to the dependent variable. Therefore, covariance of the first data day for each subject was not needed. This contention is supported by inspection of the individual student charts included in Appendix B. These charts show

Table 7

DEPENDENT AND INDEPENDENT VARIABLES

	Treatment Levels		
Independent variable	T_1 (Control)	T_2 (Charting)	T_3 (Raw Score Recording)
Dependent variables	Nonverbal reasoning performance (Average daily gain scores)		

that the general pattern of the rate of change remained the same for all children throughout the study, for as the children achieved high scores on the task, their rate did not decrease. This demonstrates the absence of a ceiling effect upon performance which may have necessitated a covariance procedure. In addition, the Coding Subtest of the WISC-R was specifically chosen so as to allow a high ceiling effect for all subjects. This task would allow enough room for improvement for those subjects who started at a high level of performance.

Another issue which addresses the selection of the dependent variable concerns the possibility of computing a single gain score derived from the first and last data points. In this study, average daily gain scores for the fourteen data days were computed so as to permit greater sensitivity of the analysis of the data. If pre and post measures had been used, several historical as well as other extraneous variables would not have been observed. These extraneous variables may have occurred during the study, thereby affecting the post scores. More specifically, by using a pre-post design, intermediate data would have been omitted which could have influenced this study.

An examination of Appendix A reveals individual data summaries from which individual gain scores can be obtained. Appendix A includes a compilation of data divided into the following categories: number correct, number incorrect, total number attempted, accuracy, and speed. Computation of the gain scores can be achieved after scanning the column labeled total number attempted. Other references to these data will be made in the section of this report entitled analysis of individual data.

After all the assumptions for the design were carefully met, an analysis of variance was computed on the average daily gain scores for the thirty subjects. Regarding the use of special analytical tools, the experimenter ran this analysis of variance program on the IBM 370/165 computer using the Statistical Package For The Social Sciences computer program labeled 22.3 (Nie, N. J., Hull, C. H., Jenkins, J. G., Steinbrenner, K., & Bent, D. H., 1975). Computing was done utilizing the facilities of the NE Regional Data Center of the State University System of Florida located on the campus of the University of Florida in Gainesville. The summary of the analysis of variance that was performed is presented in Table 8. As may be seen by this table, the obtained $\underline{F}$ ratio was shown to be statistically significant ($\underline{p} < .05$) when tested against the critical $\underline{F}$ ratio. Moreover, there was a significant difference between the SBC group and the C group as illustrated in Tables 9 and 10 using the Tukey's honestly significant difference post hoc procedure (Kirk, 1968).

The design used in this study was specifically chosen so as to maximize the reliability and generality of the grouped data. Sidman (1960) describes this design as an example of intergroup replication and stated its relationship to reliability in the following way:

Table 8

ANALYSIS OF VARIANCE SUMMARY
TABLE FOR AVERAGE DAILY GAIN SCORES

Source	Degrees of Freedom	Sum of Squares	Mean Squares	F
Between Groups	2	16.0400	8.0200	5.169*
Within Groups	27	41.8948	1.5517	
Total	29	57.9348		

* $p < .05$

Table 9

MEANS AND STANDARD DEVIATIONS FOR C GROUP, SBC GROUP, AND RSR GROUP FOR AVERAGE DAILY GAIN SCORES

Group	Count	Mean	Standard deviation
C	10	3.0276	1.0321
SBC	10	4.8065	1.5674
RSR	10	3.7367	1.0644
TOTAL	30	3.8569	1.4134

Table 10

TUKEY'S HONESTLY SIGNIFICANT DIFFERENCE PROCEDURE FOR C GROUP, SBC GROUP, AND RSR GROUP

	Differences among means		
Group Means	C group	SBC group	RSR group
C = 3.0276	---	1.7789*	.7091
SBC = 4.8065		---	1.0698
RSR = 3.7367			---

* $p < .05$

> Intergroup replication provides an indicator or reliability insofar as it demonstrates that changes in central tendency for a group can be repeated. (p. 75)

Once changes in central tendency for a group are repeated, and reliability is shown, generality can be considered. With respect to this generality, the sample was chosen so that the external validity will be applicable to fourth and fifth grade students.

Analysis of Individual Data

Analysis of individual data is presented in this chapter to provide a more extensive framework within which one may analyze trends that are not made particularly apparent in the grouped data. Individual data are presented in both tabular and graphic form (see Tables 12, 13, and 14, and Figures 4, 5, and 6). The Standard Behavior Chart used in this study was developed by Wolking (1976) and served as a graphic representation showing the effects of the experimental treatment. After viewing the tables and graphic representations that will be specifically identified in this section, one will be able to recognize the rate of improvement of performance per week as evidenced by the celeration values and the percent of change in the speed and accuracy of the performance during the entire study, as indicated by the productivity measures (Wolking and Hodgson, 1976). Table 11 reveals these measures for each subject. As shown in this table, students in the SBC group produced behavior (speed productivity) at a much greater rate than both the C and RSR groups. Additionally, the celeration

Table 11

PRODUCTIVITY AND CELERATION MEASURES FOR BOTH SPEED AND ACCURACY FOR ALL SUBJECTS

Subject	Measures				
	Speed[a] productivity	Speed[b] celeration	Accuracy[c] productivity	Accuracy[d] celeration	Total days present
			C group		
1-C	131	51.01	-0	-0.00	13
2-C	41	15.75	0	0.16	14
3-C	81	31.50	0	0.12	14
4-C	63	24.48	-0	-0.14	13
5-C	35	13.49	0	0.04	13
6-C	88	36.18	0	0.00	13
7-C	44	17.01	0	0.06	13
8-C	82	31.80	0	0.00	13
9-C	82	32.06	0	0.02	13
10-C	31	12.18	-1	-0.25	14
			SBC group		
11-SBC	132	51.36	0	0.00	13
12-SBC	132	51.14	0	0.00	12
13-SBC	117	45.38	1	0.48	13
14-SBC	118	46.06	-0	-0.19	11
15-SBC	90	35.01	1	0.46	13
16-SBC	135	55.72	1	0.42	13
17-SBC	125	48.59	0	0.00	14
18-SBC	141	54.94	-0	-0.08	14
19-SBC	61	23.82	1	0.28	13
20-SBC	76	29.66	0	0.00	14

Table 11 - continued

Subject	Measures				
	Speed[a] productivity	Speed[b] celeration	Accuracy[c] productivity	Accuracy[d] celeration	Total days present
RSR group					
21-RSR	85	33.02	0	0.18	12
22-RSR	65	25.20	0	0.00	14
23-RSR	61	23.85	0	0.05	13
24-RSR	72	28.06	3	1.08	13
25-RSR	59	24.10	0	0.18	13
26-RSR	88	34.04	0	0.00	14
27-RSR	74	30.62	0	0.00	13
28-RSR	50	19.59	0	0.14	12
29-RSR	77	29.83	-0	-0.18	14
30-RSR	104	40.60	-0	-0.11	13

Note. Values indicated as -0 imply a negligible difference in percentage change.

[a] Numbers imply percentage.

[b] Numbers imply percentage per week.

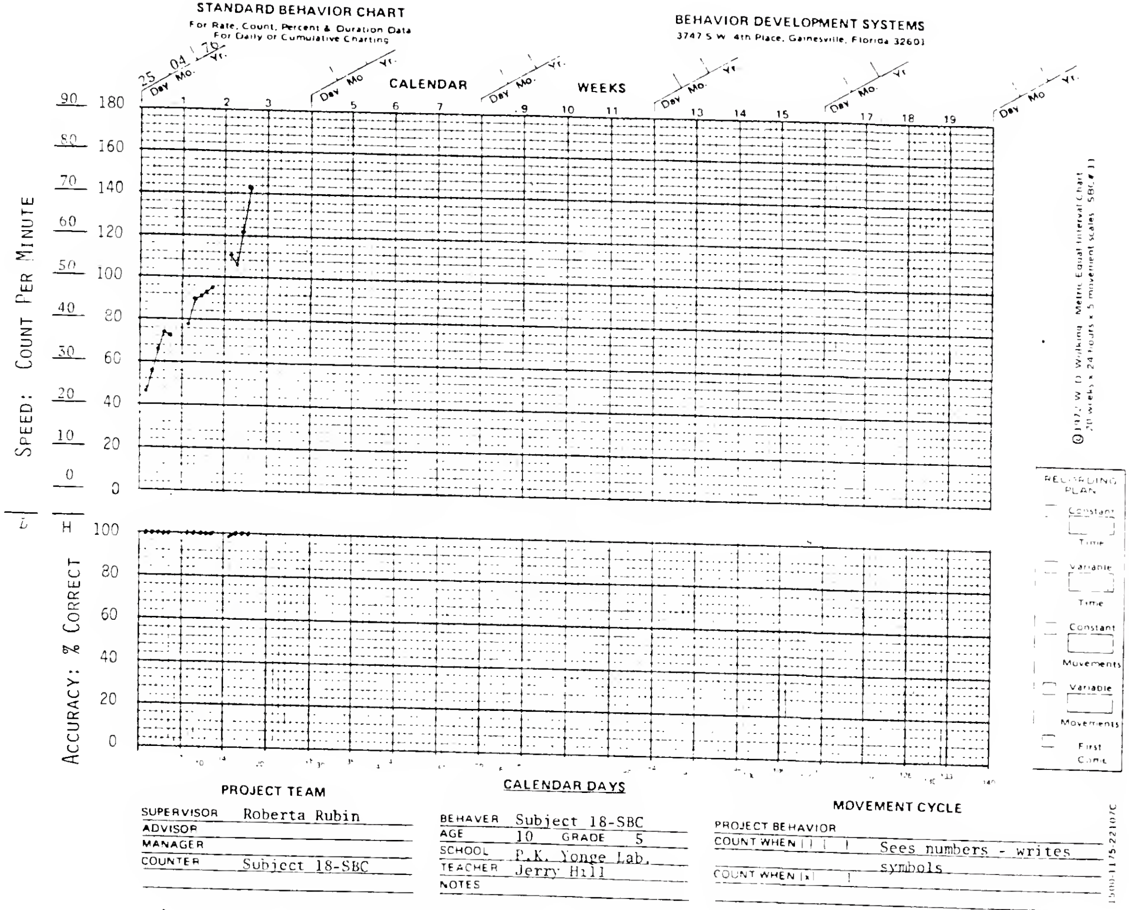
[c] Numbers imply percentage.

[d] Numbers imply percentage per week.

values for this group were higher than any other group. This trend was observed for both speed and accuracy measures. Subjects 10-C, 18-SBC, and 27-RSR were selected for individual consideration so as to reflect varying measures of both productivity and celeration. The first display of data pertains to subject number eight in the Standard Behavior Chart group (subject 18-SBC) (see Table 11 and Figure 4). As may be seen in Table 11 and graphically in Figure 4, speed celeration and speed productivity were 54.94% per week and 141% respectively. This individual's accuracy measures were consistently in the range of ninety-eight to one-hundred percent correct (see Table 12).

Figure 5 graphically summarizes the progress of subject number seven in the Raw Score Record group (subject 27-RSR). This subject progressed at a moderate to high rate which can be further emphasized after examination of Table 11. Subject 27-RSR's percent of speed celeration and speed productivity were 30.62% per week and 74% respectively. This individual's accuracy measures were calculated at 100% throughout the entire study (see Table 13).

A different representation of data can be seen in Figure 6. This student, labeled as number ten in the control group (subject 10-C), emitted responses at a fairly low rate. Examination of Table 11 shows this subject's speed productivity and speed celeration to be 31% and 12.18% per week. These figures appear to be the lowest among all data presented in Table 11. Accuracy measures, as reflected in Table 14, reveal



PROJECT TEAM

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MANAGER
COUNTER Subject 18-SBC

BEHAVER Subject 18-SBC
AGE 10 GRADE 5
SCHOOL P.K. Yonge Lab.
TEACHER Jerry Hill
NOTES

MOVEMENT CYCLE

PROJECT BEHAVIOR
COUNT WHEN Sees numbers - writes symbols
COUNT WHEN

Figure 4. SPEED AND ACCURACY SUMMARY CHART FOR SUBJECT 18-SBC.

Table 12

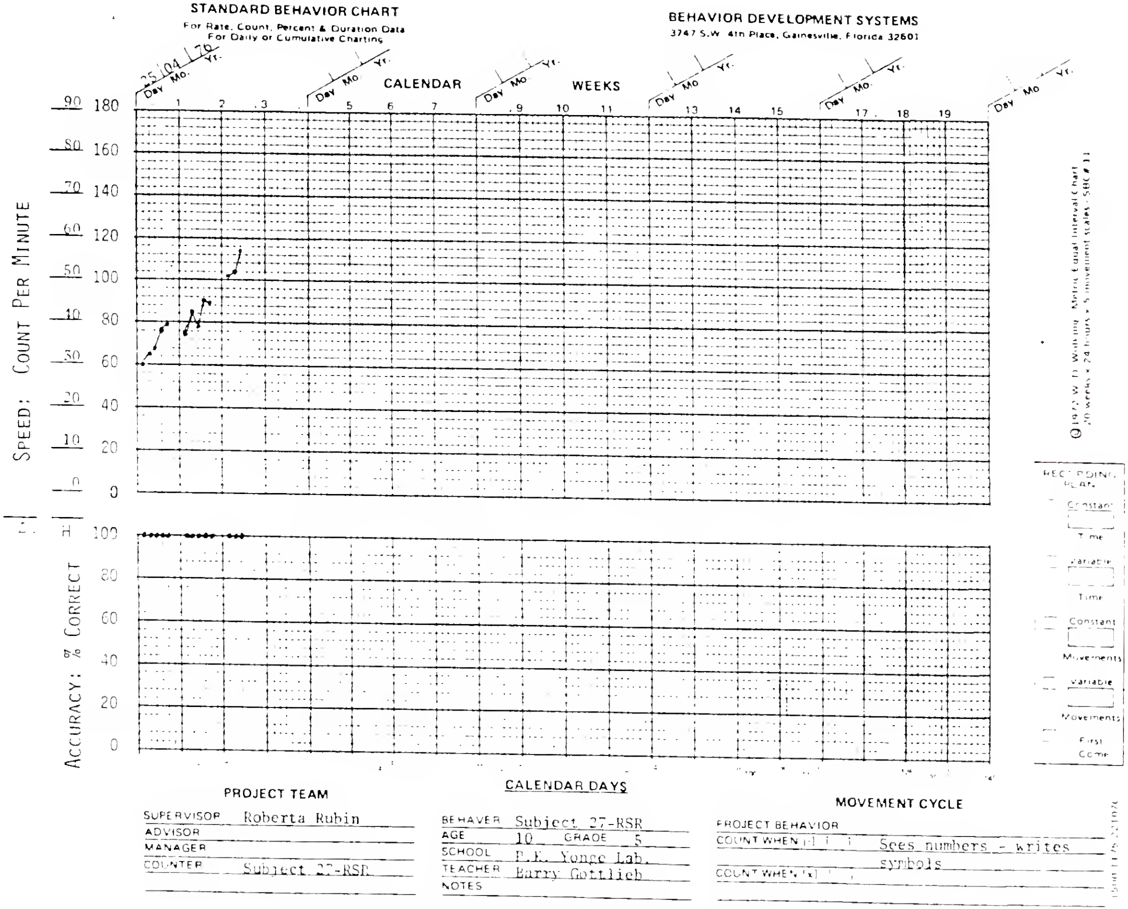
SUBJECT 18-SBC: ACCURACY; SPEED; AND NUMBER OF CORRECT, INCORRECT, AND TOTAL RESPONSES ON THE WISC-R CODING SUBTEST

Date	Session Number	Number Correct	Number Incorrect	Total Number Attempted	Accuracy[a]	Speed[b]
4-26	1	45	0	45	1.0000	22.5
4-27	2	56	0	56	1.0000	28.0
4-28	3	67	0	67	1.0000	33.5
4-29	4	75	0	75	1.0000	37.5
4-30	5	73	0	73	1.0000	36.5
5-03	6	78	0	78	1.0000	39.0
5-04	7	90	0	90	1.0000	45.0
5-05	8	91	0	91	1.0000	45.5
5-06	9	93	0	93	1.0000	46.5
5-07	10	95	0	95	1.0000	47.5
5-10	11	110	1	111	.9910	55.5
5-11	12	106	0	106	1.0000	53.0
5-12	13	122	0	122	1.0000	61.0
5-13	14	143	0	143	1.0000	71.5

Note. Each subject was given two minutes to complete the task.

[a] Accuracy is defined as number of correct divided by total number attempted.

[b] Speed is defined as the total number of attempted behaviors divided by the time.



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AGE 10 GRADE 5
SCHOOL P.K. Yonge Lab.
TEACHER Barry Gottlieb
NOTES

PROJECT BEHAVIOR
COUNT WHEN Sees numbers - writes symbols
COUNT WHEN

Figure 5. SPEED AND ACCURACY SUMMARY CHART FOR SUBJECT 27-RSR.

Table 13

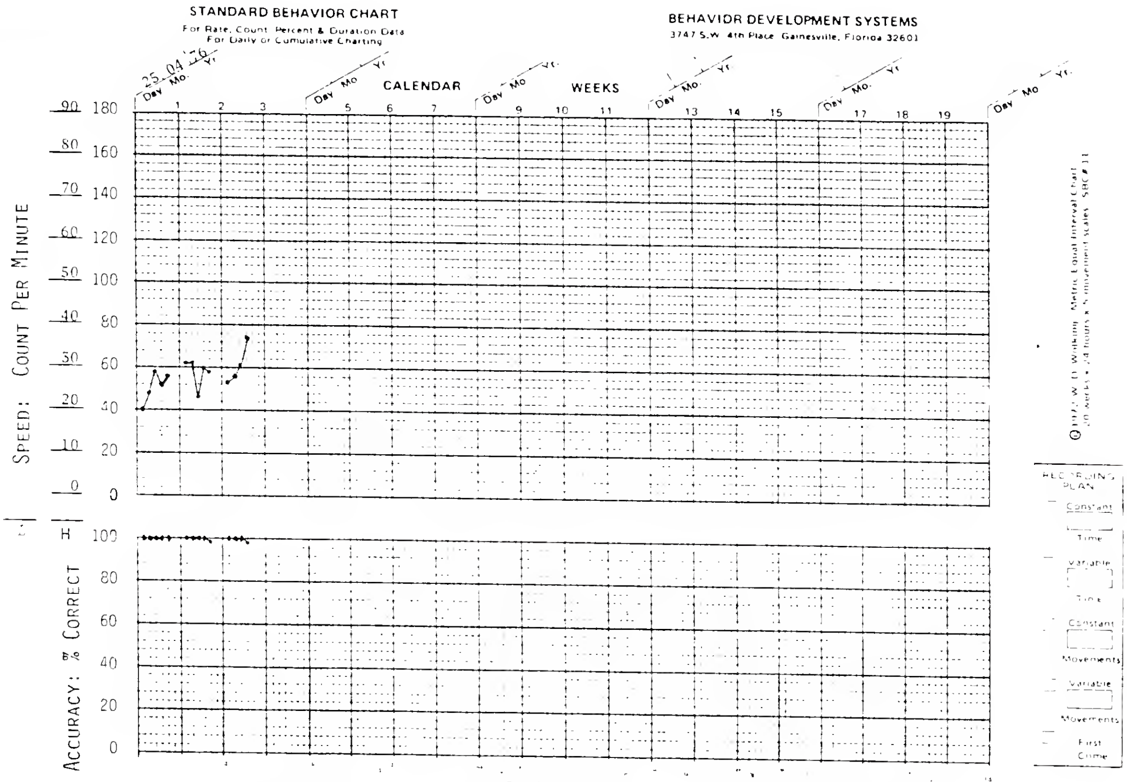
SUBJECT 27-RSR: ACCURACY; SPEED; AND NUMBER OF CORRECT, INCORRECT, AND TOTAL RESPONSES ON THE WISC-R CODING SUBTEST

Date	Session Number	Number Correct	Number Incorrect	Total Number Attempted	Accuracy[a]	Speed[b]
4-26	1	60	0	60	1.0000	30.0
4-27	2	65	0	65	1.0000	32.5
4-28	3	68	0	68	1.0000	34.0
4-29	4	76	0	76	1.0000	38.0
4-30	5	79	0	79	1.0000	39.5
5-03	6	75	0	75	1.0000	37.5
5-04	7	85	0	85	1.0000	42.5
5-05	8	78	0	78	1.0000	39.0
5-06	9	91	0	91	1.0000	45.5
5-07	10	90	0	90	1.0000	45.0
5-10	11	102	0	102	1.0000	51.0
5-11	12	104	0	104	1.0000	52.0
5-12	13	115	0	115	1.0000	57.5
5-13	14	--	-	--	------	----

Note. Each subject was given two minutes to complete the task.

[a] Accuracy is defined as number correct divided by total number attempted.

[b] Speed is defined as the total number of attempted behaviors divided by the time.



PROJECT TEAM

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BEHAVER Subject 10-C
AGE 11 GRADE 5
SCHOOL P.K. Yonge Lab.
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NOTES

MOVEMENT CYCLE

PROJECT BEHAVIOR
COUNT WHEN Sees numbers - writes symbols
COUNT WHEN

Figure 6. SPEED AND ACCURACY SUMMARY CHART FOR SUBJECT 10-C.

Table 14

SUBJECT 10-C: ACCURACY; SPEED; AND NUMBER OF CORRECT, INCORRECT, AND TOTAL RESPONSES ON THE WISC-R CODING SUBTEST

Date	Session Number	Number Correct	Number Incorrect	Total Number Attempted	Accuracy[a]	Speed[b]
4-26	1	40	0	40	1.0000	20.0
4-27	2	48	0	48	1.0000	24.0
4-28	3	57	0	57	1.0000	28.5
4-29	4	52	0	52	1.0000	26.0
4-30	5	56	0	56	1.0000	28.0
5-03	6	62	0	62	1.0000	31.0
5-04	7	62	0	62	1.0000	31.0
5-05	8	47	0	47	1.0000	23.5
5-06	9	60	0	60	1.0000	30.0
5-07	10	57	1	58	.9828	29.0
5-10	11	53	0	53	1.0000	26.5
5-11	12	56	0	56	1.0000	28.0
5-12	13	61	0	61	1.0000	30.5
5-13	14	74	1	75	.9867	37.5

Note. Each subject was given two minutes to complete the task.

[a] Accuracy is defined as number of correct divided by total number attempted.

[b] Speed is defined as the total number of attempted behaviors divided by the time.

the percentage correct to be between ninety-eight and one-hundred percent.

For the three cases reviewed and other cases illustrated in both Appendices A and B, one observes consistently high percentages for accuracy throughout the fourteen data sessions. One might have expected a decline in accuracy measures as speed increased. Such was not the case in this study, for as speed increased, accuracy did not drop.

Specific Supplementary Data

Supplemental data that was collected should not be ignored, for its inclusion may serve to explicate notable characteristics of the data. These data consist of information regarding the acquisition phase of this study, the questionnaire administered at the completion of the experiment, and a brief reference to the complete summaries of individual data. These individual data are included in Appendices A and B.

Consideration of the data that appear in Appendices A and B permits one to observe a trend during the acquisition phase for the first eight sessions of the experiment. With this in mind, an analyses of variance was run (Nie, N. H. et al., 1975) on the average daily gain scores for the first eight data days (see Appendix C). Inspection of Tables C-1, C-2, and C-3 shows the treatment levels to be statistically significant with a significant difference between the C group and the SBC group, and between the SBC group and RSR group. Perhaps, it may be concluded that the significance during acquisition for the RSR group slowly dissipated during the maintenance part of the study.

Appendix D contains the questionnaire that was administered at the end of the experiment, and Appendix E includes the corresponding tabulated results for all groups. A review of Tables E-1, E-2, E-3, and E-4 enables one to observe the greater percentage of positive comments concerning the coding task among the students in the SBC and RSR treatment groups as compared to the C group. Question number one on the questionnaire (see Appendix D) asks: How interesting do you think the coding task is after taking it everyday? In answering this, 30% of the responses in the C group indicated very interesting or slightly interesting. In contrast, 70% of the responses in the SBC group and 100% of the responses in the RSR group indicated the same responses. Moreover, one-hundred percent of the students in the SBC group stated that charting made them want to improve their score each day (see Appendix E, Table E-2). Similarly, 100% of the students in the RSR group responded favorably to the effects of using the RSR sheet (see Table E-3). When asked if they thought they would have done better charting or recording their scores, fifty percent of the C group replied "yes" (see Table E-1). Again, the favorable responses emitted by the SBC and RSR groups are readily observed in Table E-4.

A tangential issue emerges when one attends to the responses given to the question: Did the quarters make you want to come each day? Corresponding percentages for groups

C, SBC, and RSR responding "yes" were 90%, 70%, and 87.5% respectively. These comments, along with a review of the attendance records that were kept during the study, reveal commendable attendance rates once the reinforcement schedule was in effect (see Table 15).

Summary

Grouped data, selected individual data, and supplemental data were analyzed in an attempt to present a complete description of the results of this experiment.

The grouped data showed significant treatment effects with a significant difference between the SBC and C groups. Individual data analyses were done to clarify trends and to focus upon individual productivity and celeration measures for speed and accuracy pertaining to three different subjects. Again, the superiority of the treatment intervention is observable in these data and in the data of the individual tabulations and charts presented in Appendices A and B.

Interesting propositions concerning reinforcement, acquisition of responding, and questionnaire results were explored in the analyses of supplemental data. These data revealed overwhelmingly positive subjective responses concerning the experiment on the part of the SBC and RSR groups as compared to the C group. Also, the reinforcement used to increase "attending" behavior proved to support the contention that intermittent schedules, and particularly, variable schedules may have been responsible for producing the moderate to high rates of attending that prevailed in this experiment.

Table 15

NUMBER OF ABSENCES FOR THE
C, SBC, AND RSR GROUPS

Group	Total number of absences
C	3
SBC	3
RSR	5

Note. These totals reflect the total number of absences for all students in each particular group.

In addition, an analysis of variance was run on the first eight days of data. Admittedly, this analysis can only be viewed as purely ancillary; but, nevertheless, treatment levels were found significant during this acquisition phase, with a significant difference between Groups SBC and C, and between SBC and RSR.

CHAPTER V

SUMMARY AND CONCLUSIONS

This chapter will discuss the conclusions of the present study and examine implications and recommendations for future research. Also, a reference to significance of this study will be noted.

Summary

The purpose of this study was to investigate the effects of two different forms of feedback upon nonverbal reasoning performance as measured on the Coding Subtest of the WISC-R. In an attempt to expand upon the existing knowledge in this area, this study dealt with two specific methods of student self-recording.

The first type of self-recording involved the Standard Behavior Chart. In the past, this chart has been used concurrently with various modification programs in order to bring about successful changes in behavior. The present study focused upon the chart as a means of modifying behavior without any outside modification program.

The second self-recording method used in this experiment was the direct recording of raw scores technique. Students recorded their daily scores on a RSR sheet designed by the experimenter. Any results obtained from this part of the study were noteworthy in that they may serve as an extension of the literature in existence to date.

The Ss in the study were divided among three groups and were told to perform on the Coding Subtest of the WISC-R. This was done daily for a total of fourteen data sessions. Two of the treatment groups self-recorded according to the methods previously described. The third group served as a control group throughout the study.

Results showed a significant treatment effect with a significant difference between the SBC and C groups. These results confirm the importance of the reactivity of the self-recording response on the SBC. In this study, self-recording on this chart served as a reactive agent to change the subjects' performance significantly throughout the fourteen data sessions. In addition, supplemental data revealed favorable responses regarding the treatment effects. These supplemental data showed a significant treatment effect with a significant difference between the RSR and SBC groups. This treatment effect was not sustained at the completion of the experiment.

These results, combined with the ease of learning to use the two self-recording devices and the minimal expenditure of time required to self-record, strongly suggest the power that self-recording may wield in trying to modify behavior. Further elaboration of these points may be found in the section of this report entitled implications and recommendations.

Discussion

A review of the literature as it concurs or differs from this study will focus on two major areas. These areas include self-recording both with and without any concurrent modification procedures. The former will represent areas in which this study serves as an extension of present literature and the latter represents areas of concurrence with this study.

Self-Recording Without Modification Procedures

The results of this study concur with previous research which has shown that self-recording in the form of various charts and index cards serves to modify pinpointed behaviors being measured (Berger, 1972; Broden, Hall, & Mitts, 1971; Gottman & McFall, 1972; Johnson, 1971; Johnson & White, 1971; Kazlo, 1976). This modification, also referred to as the reactivity of the self-recording response, was clearly demonstrated in this study. Children's performance on the coding task in the SBC group improved at a more significant rate than the comparable control group which did not use any form of self-recording device. An analysis of the grouped data revealed a significant difference between the SBC and the C groups. It was shown that the chart used by the students in the SBC group served as a reactive agent upon the behavior being measured. This finding is in accordance with a study completed by Berger (1972) in which school-related behaviors changed in the desired direction after self-counting was recorded. Other studies which are in agreement with the present study were completed by Kazlo (1975) and Johnson and White (1971). These studies focused upon the daily self-recording of study behaviors. Results indicated a significant change in the performance of the students that self-recorded as compared to those that did not self-record.

Self-Recording With Concurrent Modification Procedures

Numerous researchers have reported favorable results pertaining to self-recording when used contemporaneously with other modification procedures (Bellack, Rozensky, & Schwartz, 1973; Bolstad & Johnson, 1972; Duncan, 1971; Glynn & Thomas, 1974; Houton & Sullivan, 1975; Knapczyk & Livingston, 1973; Mahoney, 1971; Romanczyk, Tracey, Wilson, & Thorpe, 1973; Stunkard, 1975; Zimmerman, 1975). These studies used several forms of behavior management techniques in addition to the self-recording method. These procedures included reinforcement, punishment, and stimulus control. As may be seen in the present research study, the results obtained served as an extension of the findings in this area in that significant differences were observed without the use of any concurrent modification procedures.

To recapitulate, the results of this study concurred with the literature in existence to date. Furthermore, this study isolated two types of self-recording techniques and showed the significance of the SBC without the use of any outside behavior management techniques.

Implications and Recommendations

A review of the results and particularities inherent in this study will be presented in this section along with recommendations for further research. The four issues to be considered involve different types of recording devices, the length of the experiment, the importance of supplemental data, and the functions of the self-recording response.

Several interesting considerations must be reviewed concerning different types of recording devices. The format of the RSR sheet was designed in order to isolate stimuli particular to this sheet and at the same time, to be different from the SBC. Although favorable results were obtained for the SBC, other types of recording devices should be considered in future experiments. Suggestions for other types of recording instruments include index cards, notebooks, simple behavioral graphs, or a variation of the RSR sheet. Also, recommendations for another performance task and the appropriate allotment of time assigned to it should be considered so as to provide greater generalizability for future research.

Although results were reported for fourteen data sessions, a trend was noted for the RSR group during the first eight days of the study. During the first eight days, a significant difference was observed ($p < .05$, see Tables C-1, C-2, and C-3) between the RSR and SBC groups. Apparently, the RSR acted as a potent reinforcer during the first part of the experiment, as demonstrated by the increase in performance noted for the RSR group at this time. This finding suggests the possibility of the greater effects of self-recording on a simple RSR sheet during the acquisition phase of a task than during the maintenance period. Additional research should capitalize upon this effect in an attempt to incorporate the proper feedback mechanism at the most significant time. For example, simple raw score recording devices could be used during the initial period of task acquisition with a change to more elaborate self-recording devices during maintenance periods.

Another implication of this study concerns the results obtained from the questionnaire that was administered to the students. Results derived from this supplemental data revealed favorable attitudes toward the Standard Behavior Chart as a self-recording device. Wolf (1976) emphasized the importance of positive attitudes held by subjects concerning the treatments that are administered. If this is the case, the favorable responses expressed by the students about the Standard Behavior Chart may have contributed to the significant results that were obtained. With this in mind, future research in this area should give as much consideration to subjects' attitudes about the treatments in an experiment as well as to the treatments themselves.

One other implication of this study involves the three functions that self-recording may serve. As mentioned earlier, these functions involve self-recording as a reinforcer, punisher, and as a discriminative stimulus. In this study, the reinforcing effects of self-recording on the SBC were demonstrated. If, in this study, self-recording had instead functioned as a punisher, the desirability of this technique would have been questioned. For instance, if one chooses a goal that is not obtainable, one will consistently fail. To continuously record this failure on the SBC may cause one to become apathetic and not try for improvement, and thus, result in a deceleration of the behavior being measured. Careful selection of goals with appropriate small approximations to these goals would counter this process. This accentuates the importance of individualizing different behavioral goals for different subjects. Once an acceleration or deceleration is observed on the self-recording device, the proper changes should be instituted. Additional research in this area should carefully consider the powerful effects of this reactivity of the self-recording response. Again, the particular use of feedback as a reactive agent can serve to be a very valuable tool when used in both school and clinical environments.

Significance

In addition to extending the existing knowledge in this area, this research may have significance in that it suggests new procedures for curriculum and behavior management in classroom situations. It demonstrated that charting is a reactive process and may serve to accelerate or decelerate the behavior charted. Thus, teachers and other professionals could utilize this knowledge and plan interventions which use the potential power of charted feedback. Hopefully, one outcome of this experiment may be to make professionals particularly aware of charting techniques and to encourage their successful use in academic environments. As Forness (1973) stated:

> Charting of behavioral data is of particular value to teachers and psychologists, in which one records the frequency of the occurrence of particular data in a given period of time to establish an estimate of their frequency. Charting requires only clerical skills on the part of the teacher or observer, particularly when the target behavior is clearly defined. (p. 130)

While Forness (1973) was referring primarily to charting techniques for teachers in the foregoing discourse, one can easily appreciate, and this research project successfully demonstrates, the essential function of self-recording techniques in facilitating the improvement of future educational endeavors.

APPENDICES

APPENDIX A

INDIVIDUAL DATA TABULATIONS

Table A-1

SUBJECT 1-C: ACCURACY; SPEED; AND NUMBER OF CORRECT, INCORRECT, AND TOTAL RESPONSES ON THE WISC-R CODING SUBTEST

Date	Session Number	Number Correct	Number Incorrect	Total Number Attempted	Accuracy[a]	Speed[b]
4-26	1	37	0	37	1.0000	18.5
4-27	2	42	0	42	1.0000	21.0
4-28	3	--	-	--	------	----
4-29	4	54	0	54	1.0000	27.0
4-30	5	59	0	59	1.0000	29.5
5-03	6	48	0	48	1.0000	24.0
5-04	7	68	0	68	1.0000	34.0
5-05	8	67	1	68	.9853	34.0
5-06	9	72	0	72	1.0000	36.0
5-07	10	78	0	78	1.0000	39.0
5-10	11	78	0	78	1.0000	39.0
5-11	12	84	0	84	1.0000	42.0
5-12	13	91	0	91	1.0000	45.5
5-13	14	95	0	95	1.0000	47.5

Note. Each subject was given two minutes to complete the task.

[a] Accuracy is defined as number correct divided by total number attempted.

[b] Speed is defined as the total number of attempted behaviors divided by the time.

Table A-2

SUBJECT 2-C: ACCURACY; SPEED; AND NUMBER OF CORRECT, INCORRECT, AND TOTAL RESPONSES ON THE WISC-R CODING SUBTEST

Date	Session Number	Number Correct	Number Incorrect	Total Number Attempted	Accuracy[a]	Speed[b]
4-26	1	46	0	46	1.0000	23.0
4-27	2	58	0	58	1.0000	29.0
4-28	3	57	0	57	1.0000	28.5
4-29	4	49	1	50	.9800	25.0
4-30	5	61	0	61	1.0000	30.5
5-03	6	51	0	51	1.0000	25.5
5-04	7	67	1	68	.9853	34.0
5-05	8	59	1	60	.9833	30.0
5-06	9	67	0	67	1.0000	33.5
5-07	10	57	0	57	1.0000	28.5
5-10	11	71	0	71	1.0000	35.5
5-11	12	67	0	67	1.0000	33.5
5-12	13	70	0	70	1.0000	35.0
5-13	14	75	0	75	1.0000	37.5

Note. Each subject was given two minutes to complete the task.

[a] Accuracy is defined as number of correct divided by total number attempted.

[b] Speed is defined as the total number of attempted behaviors divided by the time.

Table A-3

SUBJECT 3-C: ACCURACY; SPEED; AND NUMBER OF CORRECT, INCORRECT, AND TOTAL RESPONSES ON THE WISC-R CODING SUBTEST

Date	Session Number	Number Correct	Number Incorrect	Total Number Attempted	Accuracy[a]	Speed[b]
4-26	1	42	0	42	1.0000	21.0
4-27	2	41	0	41	1.0000	20.5
4-28	3	45	0	45	1.0000	22.5
4-29	4	51	0	51	1.0000	25.5
4-30	5	46	1	47	.9787	23.5
5-03	6	56	0	56	1.0000	28.0
5-04	7	57	0	57	1.0000	28.5
5-05	8	54	1	55	.9818	27.5
5-06	9	65	0	65	1.0000	32.5
5-07	10	66	0	66	1.0000	33.0
5-10	11	65	0	65	1.0000	32.5
5-11	12	69	0	69	1.0000	34.5
5-12	13	72	0	72	1.0000	36.0
5-13	14	78	0	78	1.0000	39.0

Note. Each subject was given two minutes to complete the task.

[a] Accuracy is defined as number of correct divided by total number attempted.

[b] Speed is defined as the total number of attempted behaviors divided by the time.

Table A-4

SUBJECT 4-C: ACCURACY; SPEED; AND NUMBER OF CORRECT, INCORRECT, AND TOTAL RESPONSES ON THE WISC-R CODING SUBTEST

Date	Session Number	Number Correct	Number Incorrect	Total Number Attempted	Accuracy[a]	Speed[b]
4-26	1	48	0	48	1.0000	24.0
4-27	2	51	0	51	1.0000	25.5
4-28	3	58	0	58	1.0000	29.0
4-29	4	--	-	--	------	----
4-30	5	59	0	59	1.0000	29.5
5-03	6	61	0	61	1.0000	30.5
5-04	7	63	0	63	1.0000	31.5
5-05	8	66	0	66	1.0000	33.0
5-06	9	67	1	68	.9853	34.0
5-07	10	75	0	75	1.0000	37.5
5-10	11	75	1	76	.9868	38.0
5-11	12	76	0	76	1.0000	38.0
5-12	13	84	0	84	1.0000	42.0
5-13	14	79	0	79	1.0000	39.5

Note. Each subject was given two minutes to complete the task.

[a] Accuracy is defined as number of correct divided by total number attempted.

[b] Speed is defined as the total number of attempted behaviors divided by the time.

Table A-5

SUBJECT 5-C: ACCURACY; SPEED; AND NUMBER OF CORRECT, INCORRECT, AND TOTAL RESPONSES ON THE WISC-R CODING SUBTEST

Date	Session Number	Number Correct	Number Incorrect	Total Number Attempted	Accuracy[a]	Speed[b]
4-26	1	49	0	49	1.0000	24.5
4-27	2	--	-	--	------	----
4-28	3	46	0	46	1.0000	23.0
4-29	4	52	0	52	1.0000	26.0
4-30	5	53	0	53	1.0000	26.5
5-03	6	57	0	57	1.0000	28.5
5-04	7	44	1	45	.9778	22.5
5-05	8	50	0	50	1.0000	25.0
5-06	9	58	0	58	1.0000	29.0
5-07	10	63	0	63	1.0000	31.5
5-10	11	60	0	60	1.0000	30.0
5-11	12	60	0	60	1.0000	30.0
5-12	13	58	0	58	1.0000	29.0
5-13	14	69	0	69	1.0000	34.5

Note. Each subject was given two minutes to complete the task.

[a] Accuracy is defined as number of correct divided by total number attempted.

[b] Speed is defined as the total number of attempted behaviors divided by the time.

Table A-6

SUBJECT 6-C: ACCURACY; SPEED; AND NUMBER OF CORRECT, INCORRECT, AND TOTAL RESPONSES ON THE WISC-R CODING SUBTEST

Date	Session Number	Number Correct	Number Incorrect	Total Number Attempted	Accuracy[a]	Speed[b]
4-26	1	--	-	--	------	----
4-27	2	44	0	44	1.0000	22.0
4-28	3	53	0	53	1.0000	26.5
4-29	4	56	0	56	1.0000	28.0
4-30	5	56	0	56	1.0000	28.0
5-03	6	58	0	58	1.0000	29.0
5-04	7	65	0	65	1.0000	32.5
5-05	8	75	0	75	1.0000	37.5
5-06	9	76	0	76	1.0000	38.0
5-07	10	82	0	82	1.0000	41.0
5-10	11	86	0	86	1.0000	43.0
5-11	12	86	0	86	1.0000	43.0
5-12	13	80	0	80	1.0000	40.0
5-13	14	91	0	91	1.0000	45.5

Note. Each subject was given two minutes to complete the task.

[a] Accuracy is defined as number of correct divided by total number attempted.

[b] Speed is defined as the total number of attempted behaviors divided by the time.

Table A-7

SUBJECT 7-C: ACCURACY; SPEED; AND NUMBER OF CORRECT, INCORRECT, AND TOTAL RESPONSES ON THE WISC-R CODING SUBTEST

Date	Session Number	Number Correct	Number Incorrect	Total Number Attempted	Accuracy[a]	Speed[b]
4-26	1	42	0	42	1.0000	21.0
4-27	2	47	0	47	1.0000	23.5
4-28	3	53	0	53	1.0000	26.5
4-29	4	--	-	--	------	----
4-30	5	55	0	55	1.0000	27.5
5-03	6	52	1	53	.9811	26.5
5-04	7	62	0	62	1.0000	31.0
5-05	8	62	0	62	1.0000	31.0
5-06	9	62	0	62	1.0000	31.0
5-07	10	64	0	64	1.0000	32.0
5-10	11	62	0	62	1.0000	31.0
5-11	12	61	0	61	1.0000	30.5
5-12	13	68	0	68	1.0000	34.0
5-13	14	68	0	68	1.0000	34.0

Note. Each subject was given two minutes to complete the task.

[a] Accuracy is defined as number of correct divided by total number attempted.

[b] Speed is defined as the total number of attempted behaviors divided by the time.

Table A-8

SUBJECT 8-C: ACCURACY; SPEED; AND NUMBER OF CORRECT, INCORRECT, AND TOTAL RESPONSES ON THE WISC-R CODING SUBTEST

Date	Session Number	Number Correct	Number Incorrect	Total Number Attempted	Accuracy[a]	Speed[b]
4-26	1	46	0	46	1.0000	23.0
4-27	2	46	0	46	1.0000	23.0
4-28	3	64	0	64	1.0000	32.0
4-29	4	--	-	--	------	----
4-30	5	68	0	68	1.0000	34.0
5-03	6	66	0	66	1.0000	33.0
5-04	7	71	0	71	1.0000	35.5
5-05	8	68	0	68	1.0000	34.0
5-06	9	80	0	80	1.0000	40.0
5-07	10	92	0	92	1.0000	46.0
5-10	11	78	0	78	1.0000	39.0
5-11	12	83	0	83	1.0000	41.5
5-12	13	86	0	86	1.0000	43.0
5-13	14	99	0	99	1.0000	49.5

Note. Each subject was given two minutes to complete the task.

[a] Accuracy is defined as number of correct divided by total number attempted.

[b] Speed is defined as the total number of attempted behaviors divided by the time.

Table A-9

SUBJECT 9-C: ACCURACY; SPEED; AND NUMBER OF CORRECT, INCORRECT, AND TOTAL RESPONSES ON THE WISC-R CODING SUBTEST

Date	Session Number	Number Correct	Number Incorrect	Total Number Attempted	Accuracy[a]	Speed[b]
4-26	1	36	0	36	1.0000	18.0
4-27	2	39	0	39	1.0000	19.5
4-28	3	42	0	42	1.0000	21.0
4-29	4	--	-	--	------	----
4-30	5	51	0	51	1.0000	25.5
5-03	6	47	1	48	.9792	24.0
5-04	7	49	0	49	1.0000	24.5
5-05	8	51	0	51	1.0000	25.5
5-06	9	51	1	52	.9808	26.0
5-07	10	62	0	62	1.0000	31.0
5-10	11	61	0	61	1.0000	30.5
5-11	12	61	0	61	1.0000	30.5
5-12	13	68	0	68	1.0000	34.0
5-13	14	72	0	72	1.0000	36.0

Note. Each subject was given two minutes to complete the task.

[a] Accuracy is defined as number of correct divided by total number attempted.

[b] Speed is defined as the total number of attempted behaviors divided by the time.

Table A-10

SUBJECT 11-SBC: ACCURACY; SPEED; AND NUMBER OF CORRECT, INCORRECT, AND TOTAL RESPONSES ON THE WISC-R CODING SUBTEST

Date	Session Number	Number Correct	Number Incorrect	Total Number Attempted	Accuracy[a]	Speed[b]
4-26	1	33	0	33	1.0000	16.5
4-27	2	37	0	37	1.0000	18.5
4-28	3	45	0	45	1.0000	22.5
4-29	4	--	-	--	------	----
4-30	5	52	0	52	1.0000	26.0
5-03	6	57	0	57	1.0000	28.5
5-04	7	65	0	65	1.0000	32.5
5-05	8	65	0	65	1.0000	32.5
5-06	9	66	0	66	1.0000	33.0
5-07	10	68	0	68	1.0000	34.0
5-10	11	71	0	71	1.0000	35.5
5-11	12	74	0	74	1.0000	37.0
5-12	13	85	0	85	1.0000	42.5
5-13	14	90	0	90	1.0000	45.0

Note. Each subject was given two minutes to complete the task.

[a] Accuracy is defined as number of correct divided by total number attempted.

[b] Speed is defined as the total number of attempted behaviors divided by the time.

Table A-11

SUBJECT 12-SBC: ACCURACY; SPEED; AND NUMBER OF CORRECT, INCORRECT, AND TOTAL RESPONSES ON THE WISC-R CODING SUBTEST

Date	Session Number	Number Correct	Number Incorrect	Total Number Attempted	Accuracy[a]	Speed[b]
4-26	1	39	0	39	1.0000	19.5
4-27	2	56	0	56	1.0000	28.0
4-28	3	66	0	66	1.0000	33.0
4-29	4	--	-	--	------	----
4-30	5	74	0	74	1.0000	37.0
5-03	6	82	0	82	1.0000	41.0
5-04	7	88	0	88	1.0000	44.0
5-05	8	98	0	98	1.0000	49.0
5-06	9	100	0	100	1.0000	50.0
5-07	10	107	0	107	1.0000	53.5
5-10	11	114	0	114	1.0000	57.0
5-11	12	---	-	---	------	----
5-12	13	108	0	108	1.0000	54.0
5-13	14	118	0	118	1.0000	59.0

Note. Each subject was given two minutes to complete the task.

[a] Accuracy is defined as number of correct divided by total number attempted.

[b] Speed is defined as the total number of attempted behaviors divided by the time.

Table A-12

SUBJECT 13-SBC: ACCURACY; SPEED; AND NUMBER OF CORRECT, INCORRECT, AND TOTAL RESPONSES ON THE WISC-R CODING SUBTEST

Date	Session Number	Number Correct	Number Incorrect	Total Number Attempted	Accuracy[a]	Speed[b]
4-26	1	29	1	30	.9667	15.0
4-27	2	37	0	37	1.0000	18.5
4-28	3	50	0	50	1.0000	25.0
4-29	4	--	-	--	------	----
4-30	5	59	0	59	1.0000	29.5
5-03	6	54	0	54	1.0000	27.0
5-04	7	49	0	49	1.0000	24.5
5-05	8	65	1	66	.9848	33.0
5-06	9	68	0	68	1.0000	34.0
5-07	10	75	0	75	1.0000	37.5
5-10	11	76	0	76	1.0000	38.0
5-11	12	72	0	72	1.0000	36.0
5-12	13	77	0	77	1.0000	38.5
5-13	14	84	0	84	1.0000	42.0

Note. Each subject was given two minutes to complete the task.

[a] Accuracy is defined as number of correct divided by total number attempted.

[b] Speed is defined as the total number of attempted behaviors divided by the time.

Table A-13

SUBJECT 14-SBC: ACCURACY; SPEED; AND NUMBER OF CORRECT, INCORRECT, AND TOTAL RESPONSES ON THE WISC-R CODING SUBTEST

Date	Session Number	Number Correct	Number Incorrect	Total Number Attempted	Accuracy[a]	Speed[b]
4-26	1	35	0	35	1.0000	17.5
4-27	2	35	0	35	1.0000	17.5
4-28	3	44	0	44	1.0000	22.0
4-29	4	51	0	51	1.0000	25.5
4-30	5	--	-	--	------	----
5-03	6	64	0	64	1.0000	32.0
5-04	7	52	0	52	1.0000	26.0
5-05	8	65	0	65	1.0000	32.5
5-06	9	57	1	58	.9828	29.0
5-07	10	63	1	64	.9844	32.0
5-10	11	--	-	--	------	----
5-11	12	--	-	--	------	----
5-12	13	78	0	78	1.0000	39.0
5-13	14	83	0	83	1.0000	41.5

Note. Each subject was given two minutes to complete the task.

[a] Accuracy is defined as number of correct divided by total number attempted.

[b] Speed is defined as the total number of attempted behaviors divided by the time.

Table A-14

SUBJECT 15-SBC: ACCURACY; SPEED; AND NUMBER OF CORRECT, INCORRECT, AND TOTAL RESPONSES ON THE WISC-R CODING SUBTEST

Date	Session Number	Number Correct	Number Incorrect	Total Number Attempted	Accuracy[a]	Speed[b]
4-26	1	22	0	22	1.0000	11.0
4-27	2	24	1	25	.9600	12.5
4-28	3	32	0	32	1.0000	16.0
4-29	4	31	0	31	1.0000	15.5
4-30	5	35	0	35	1.0000	17.5
5-03	6	37	0	37	1.0000	18.5
5-04	7	36	0	36	1.0000	18.0
5-05	8	41	0	41	1.0000	20.5
5-06	9	40	0	40	1.0000	20.0
5-07	10	46	0	46	1.0000	23.0
5-10	11	--	-	--	------	----
5-11	12	45	0	45	1.0000	22.5
5-12	13	44	0	44	1.0000	22.0
5-13	14	52	0	52	1.0000	26.0

Note. Each subject was given two minutes to complete the task.

[a] Accuracy is defined as number of correct divided by total number attempted.

[b] Speed is defined as the total number of attempted behaviors divided by the time.

Table A-15

SUBJECT 16-SBC: ACCURACY; SPEED; AND NUMBER OF CORRECT, INCORRECT, AND TOTAL RESPONSES ON THE WISC-R CODING SUBTEST

Date	Session Number	Number Correct	Number Incorrect	Total Number Attempted	Accuracy[a]	Speed[b]
4-26	1	--	-	--	-------	----
4-27	2	32	0	32	1.0000	16.0
4-28	3	44	0	44	1.0000	22.0
4-29	4	44	1	45	.9777	22.5
4-30	5	52	1	53	.9811	26.5
5-03	6	56	0	56	1.0000	28.0
5-04	7	61	0	61	1.0000	30.5
5-05	8	64	0	64	1.0000	32.0
5-06	9	68	0	68	1.0000	34.0
5-07	10	71	0	71	1.0000	35.5
5-10	11	75	0	75	1.0000	37.5
5-11	12	80	0	80	1.0000	40.0
5-12	13	88	0	88	1.0000	44.0
5-13	14	93	0	93	1.0000	46.5

Note. Each subject was given two minutes to complete the task.

[a] Accuracy is defined as number of correct divided by total number attempted.

[b] Speed is defined as the total number of attempted behaviors divided by the time.

Table A-16

SUBJECT 17-SBC: ACCURACY; SPEED; AND NUMBER OF CORRECT, INCORRECT, AND TOTAL RESPONSES ON THE WISC-R CODING SUBTEST

Date	Session Number	Number Correct	Number Incorrect	Total Number Attempted	Accuracy[a]	Speed[b]
4-26	1	32	0	32	1.0000	16.0
4-27	2	44	0	44	1.0000	22.0
4-28	3	54	0	54	1.0000	27.0
4-29	4	54	0	54	1.0000	27.0
4-30	5	49	0	49	1.0000	24.5
5-03	6	64	0	64	1.0000	32.0
5-04	7	75	0	75	1.0000	37.5
5-05	8	75	0	75	1.0000	37.5
5-06	9	82	0	82	1.0000	41.0
5-07	10	75	0	75	1.0000	37.5
5-10	11	80	0	80	1.0000	40.0
5-11	12	88	0	88	1.0000	44.0
5-12	13	88	0	88	1.0000	44.0
5-13	14	93	0	93	1.0000	46.5

Note. Each subject was given two minutes to complete the task.

[a] Accuracy is defined as number of correct divided by total number attempted.

[b] Speed is defined as the total number of attempted behaviors divided by the time.

Table A-17

SUBJECT 19-SBC: ACCURACY; SPEED; AND NUMBER OF CORRECT, INCORRECT, AND TOTAL RESPONSES ON THE WISC-R CODING SUBTEST

Date	Session Number	Number Correct	Number Incorrect	Total Number Attempted	Accuracy[a]	Speed[b]
4-26	1	34	1	35	.9714	17.5
4-27	2	45	0	45	1.0000	22.5
4-28	3	50	0	50	1.0000	25.0
4-29	4	--	-	--	------	----
4-30	5	50	0	50	1.0000	25.0
5-03	6	65	0	65	1.0000	32.5
5-04	7	64	0	64	1.0000	32.0
5-05	8	65	0	65	1.0000	32.5
5-06	9	65	0	65	1.0000	32.5
5-07	10	56	0	56	1.0000	28.0
5-10	11	62	1	63	.9841	31.5
5-11	12	68	0	68	1.0000	34.0
5-12	13	64	0	64	1.0000	32.0
5-13	14	74	0	74	1.0000	37.0

Note. Each subject was given two minutes to complete the task.

[a] Accuracy is defined as number of correct divided by total number attempted.

[b] Speed is defined as the total number of attempted behaviors divided by the time.

Table A-18

SUBJECT 20-SBC: ACCURACY; SPEED; AND NUMBER OF CORRECT, INCORRECT, AND TOTAL RESPONSES ON THE WISC-R CODING SUBTEST

Date	Session Number	Number Correct	Number Incorrect	Total Number Attempted	Accuracy[a]	Speed[b]
4-26	1	38	0	38	1.0000	19.0
4-27	2	48	0	48	1.0000	24.0
4-28	3	54	0	54	1.0000	27.0
4-29	4	66	0	66	1.0000	33.0
4-30	5	61	0	61	1.0000	30.5
5-03	6	63	0	63	1.0000	31.5
5-04	7	75	0	75	1.0000	37.5
5-05	8	77	0	77	1.0000	38.5
5-06	9	79	0	79	1.0000	39.5
5-07	10	82	0	82	1.0000	41.0
5-10	11	72	0	72	1.0000	36.0
5-11	12	80	0	80	1.0000	40.0
5-12	13	83	0	83	1.0000	41.5
5-13	14	87	0	87	1.0000	43.5

Note. Each subject was given two minutes to complete the task.

[a] Accuracy is defined as number of correct divided by total number attempted.

[b] Speed is defined as the total number of attempted behaviors divided by the time.

Table A-19

SUBJECT 21-RSR: ACCURACY; SPEED; AND NUMBER OF CORRECT, INCORRECT, AND TOTAL RESPONSES ON THE WISC-R CODING SUBTEST

Date	Session Number	Number Correct	Number Incorrect	Total Number Attempted	Accuracy[a]	Speed[b]
4-26	1	55	0	55	1.0000	27.5
4-27	2	66	0	66	1.0000	33.0
4-28	3	62	1	63	.9841	31.5
4-29	4	--	-	--	------	----
4-30	5	67	0	67	1.0000	33.5
5-03	6	73	0	73	1.0000	36.5
5-04	7	85	0	85	1.0000	42.5
5-05	8	87	0	87	1.0000	43.5
5-06	9	95	0	95	1.0000	47.5
5-07	10	100	0	100	1.0000	50.0
5-10	11	100	0	100	1.0000	50.0
5-11	12	--	-	--	------	----
5-12	13	102	0	102	1.0000	51.0
5-13	14	104	0	104	1.0000	52.0

Note. Each subject was given two minutes to complete the task.

[a] Accuracy is defined as number correct divided by total number attempted.

[b] Speed is defined as the total number of attempted behaviors divided by the time.

Table A-20

SUBJECT 22-RSR: ACCURACY; SPEED; AND NUMBER OF CORRECT, INCORRECT, AND TOTAL RESPONSES ON THE WISC-R CODING SUBTEST

Date	Session Number	Number Correct	Number Incorrect	Total Number Attempted	Accuracy[a]	Speed[b]
4-26	1	56	0	56	1.0000	28.0
4-27	2	73	0	73	1.0000	36.5
4-28	3	80	0	80	1.0000	40.0
4-29	4	79	0	79	1.0000	39.5
4-30	5	93	0	93	1.0000	46.5
5-03	6	98	0	98	1.0000	49.0
5-04	7	85	0	85	1.0000	42.5
5-05	8	100	0	100	1.0000	50.0
5-06	9	101	0	101	1.0000	50.5
5-07	10	105	0	105	1.0000	52.5
5-10	11	102	0	102	1.0000	51.0
5-11	12	95	0	95	1.0000	47.5
5-12	13	114	0	114	1.0000	57.0
5-13	14	126	0	126	1.0000	63.0

Note. Each subject was given two minutes to complete the task.

[a] Accuracy is defined as number correct divided by total number attempted.

[b] Speed is defined as the total number of attempted behaviors divided by the time.

Table A-21

SUBJECT 23-RSR: ACCURACY; SPEED; AND NUMBER OF CORRECT, INCORRECT, AND TOTAL RESPONSES ON THE WISC-R CODING SUBTEST

Date	Session Number	Number Correct	Number Incorrect	Total Number Attempted	Accuracy[a]	Speed[b]
4-26	1	48	0	48	1.0000	24.0
4-27	2	64	0	64	1.0000	32.0
4-28	3	73	1	74	.9865	37.0
4-29	4	--	-	--	------	----
4-30	5	72	0	72	1.0000	36.0
5-03	6	77	0	77	1.0000	38.5
5-04	7	70	1	71	.9859	35.5
5-05	8	71	0	71	1.0000	35.5
5-06	9	84	0	84	1.0000	42.0
5-07	10	77	0	77	1.0000	38.5
5-10	11	88	0	88	1.0000	44.0
5-11	12	88	1	89	.9888	44.5
5-12	13	94	0	94	1.0000	47.0
5-13	14	100	0	100	1.0000	50.0

Note. Each subject was given two minutes to complete the task.

[a] Accuracy is defined as number correct divided by total number attempted.

[b] Speed is defined as the total number of attempted behaviors divided by the time.

Table A-22

SUBJECT 24-RSR: ACCURACY; SPEED; AND NUMBER OF CORRECT, INCORRECT, AND TOTAL RESPONSES ON THE WISC-R CODING SUBTEST

Date	Session Number	Number Correct	Number Incorrect	Total Number Attempted	Accuracy^a	Speed^b
4-26	1	20	1	21	.9524	10.5
4-27	2	30	0	30	1.0000	15.0
4-28	3	29	1	30	.9667	15.0
4-29	4	--	-	--	------	----
4-30	5	26	0	26	1.0000	13.0
5-03	6	39	0	39	1.0000	19.5
5-04	7	32	0	32	1.0000	16.0
5-05	8	34	0	34	1.0000	17.0
5-06	9	40	0	40	1.0000	20.0
5-07	10	38	0	38	1.0000	19.0
5-10	11	38	0	38	1.0000	19.0
5-11	12	41	0	41	1.0000	20.5
5-12	13	45	0	45	1.0000	22.5
5-13	14	43	0	43	1.0000	21.5

Note. Each subject was given two minutes to complete the task.

[a] Accuracy is defined as number correct divided by total number attempted.

[b] Speed is defined as the total number of attempted behaviors divided by the time.

Table A-23

SUBJECT 25-RSR: ACCURACY; SPEED; AND NUMBER OF CORRECT, INCORRECT, AND TOTAL RESPONSES ON THE WISC-R CODING SUBTEST

Date	Session Number	Number Correct	Number Incorrect	Total Number Attempted	Accuracy[a]	Speed[b]
4-26	1	55	0	55	1.0000	27.5
4-27	2	57	0	57	1.0000	28.5
4-28	3	59	1	60	.9833	30.0
4-29	4	64	0	64	1.0000	32.0
4-30	5	72	0	72	1.0000	36.0
5-03	6	60	0	60	1.0000	30.0
5-04	7	76	0	76	1.0000	38.0
5-05	8	77	0	77	1.0000	38.5
5-06	9	77	0	77	1.0000	38.5
5-07	10	76	0	76	1.0000	38.0
5-10	11	89	0	89	1.0000	44.5
5-11	12	88	0	88	1.0000	44.0
5-12	13	87	0	87	1.0000	43.5
5-13	14	--	-	--	------	----

Note. Each subject was given two minutes to complete the task.

[a] Accuracy is defined as number correct divided by total number attempted.

[b] Speed is defined as the total number of attempted behaviors divided by the time.

Table A-24

SUBJECT 26-RSR: ACCURACY; SPEED; AND NUMBER OF CORRECT, INCORRECT, AND TOTAL RESPONSES ON THE WISC-R CODING SUBTEST

Date	Session Number	Number Correct	Number Incorrect	Total Number Attempted	Accuracy[a]	Speed[b]
4-26	1	45	0	45	1.0000	22.5
4-27	2	52	0	52	1.0000	26.0
4-28	3	62	0	62	1.0000	31.0
4-29	4	68	0	68	1.0000	34.0
4-30	5	68	0	68	1.0000	34.0
5-03	6	81	0	81	1.0000	40.5
5-04	7	91	0	91	1.0000	45.5
5-05	8	84	0	84	1.0000	42.0
5-06	9	86	0	86	1.0000	43.0
5-07	10	87	0	87	1.0000	43.5
5-10	11	91	0	91	1.0000	45.5
5-11	12	97	0	97	1.0000	48.5
5-12	13	102	0	102	1.0000	51.0
5-13	14	96	0	96	1.0000	48.0

Note. Each subject was given two minutes to complete the task.

[a] Accuracy is defined as number correct divided by total number attempted.

[b] Speed is defined as the total number of attempted behaviors divided by the time.

Table A-25

SUBJECT 28-RSR: ACCURACY; SPEED; AND NUMBER OF CORRECT, INCORRECT, AND TOTAL RESPONSES ON THE WISC-R CODING SUBTEST

Date	Session Number	Number Correct	Number Incorrect	Total Number Attempted	Accuracy[a]	Speed[b]
4-26	1	55	0	55	1.0000	27.5
4-27	2	62	0	62	1.0000	31.0
4-28	3	67	1	68	.9853	34.0
4-29	4	72	0	72	1.0000	36.0
5-30	5	77	0	77	1.0000	38.5
5-03	6	80	0	80	1.0000	40.0
5-04	7	78	0	78	1.0000	39.0
5-05	8	--	-	--	------	----
5-06	9	82	0	82	1.0000	41.0
5-07	10	--	-	--	------	----
5-10	11	89	0	89	1.0000	44.5
5-11	12	93	0	93	1.0000	46.5
5-12	13	93	0	93	1.0000	46.5
5-13	14	90	0	90	1.0000	45.0

Note. Each subject was given two minutes to complete the task.

[a] Accuracy is defined as number correct divided by total number attempted.

[b] Speed is defined as the total number of attempted behaviors divided by the time.

Table A-26

SUBJECT 29-RSR: ACCURACY; SPEED; AND NUMBER OF CORRECT, INCORRECT, AND TOTAL RESPONSES ON THE WISC-R CODING SUBTEST

Date	Session Number	Number Correct	Number Incorrect	Total Number Attempted	Accuracy[a]	Speed[b]
4-26	1	43	0	43	1.0000	21.5
4-27	2	46	0	46	1.0000	23.0
4-28	3	49	0	49	1.0000	24.5
4-29	4	53	0	53	1.0000	26.5
4-30	5	63	0	63	1.0000	31.5
5-03	6	57	0	57	1.0000	28.5
5-04	7	63	0	63	1.0000	31.5
5-05	8	67	1	68	.9853	34.0
5-06	9	71	0	71	1.0000	35.5
5-07	10	71	0	71	1.0000	35.5
5-10	11	78	0	78	1.0000	39.0
5-11	12	75	0	75	1.0000	37.5
5-12	13	77	0	77	1.0000	38.5
5-13	14	80	1	81	.9877	40.5

Note. Each subject was given two minutes to complete the task.

[a] Accuracy is defined as number correct divided by total number attempted.

[b] Speed is defined as the total number of attempted behaviors divided by the time.

Table A-27

SUBJECT 30-RSR: ACCURACY; SPEED; AND NUMBER OF CORRECT, INCORRECT, AND TOTAL RESPONSES ON THE WISC-R CODING SUBTEST

Date	Session Number	Number Correct	Number Incorrect	Total Number Attempted	Accuracy[a]	Speed[b]
4-26	1	44	0	44	1.0000	22.0
4-27	2	56	0	56	1.0000	28.0
4-28	3	52	0	52	1.0000	26.0
4-29	4	--	-	--	------	----
4-30	5	57	0	57	1.0000	28.5
5-03	6	59	0	59	1.0000	29.5
5-04	7	61	0	61	1.0000	30.5
5-05	8	58	0	58	1.0000	29.0
5-06	9	68	0	68	1.0000	34.0
5-07	10	77	0	77	1.0000	38.5
5-10	11	77	1	78	.9872	39.0
5-11	12	93	0	93	1.0000	46.5
5-12	13	93	0	93	1.0000	46.5
5-13	14	93	0	93	1.0000	46.5

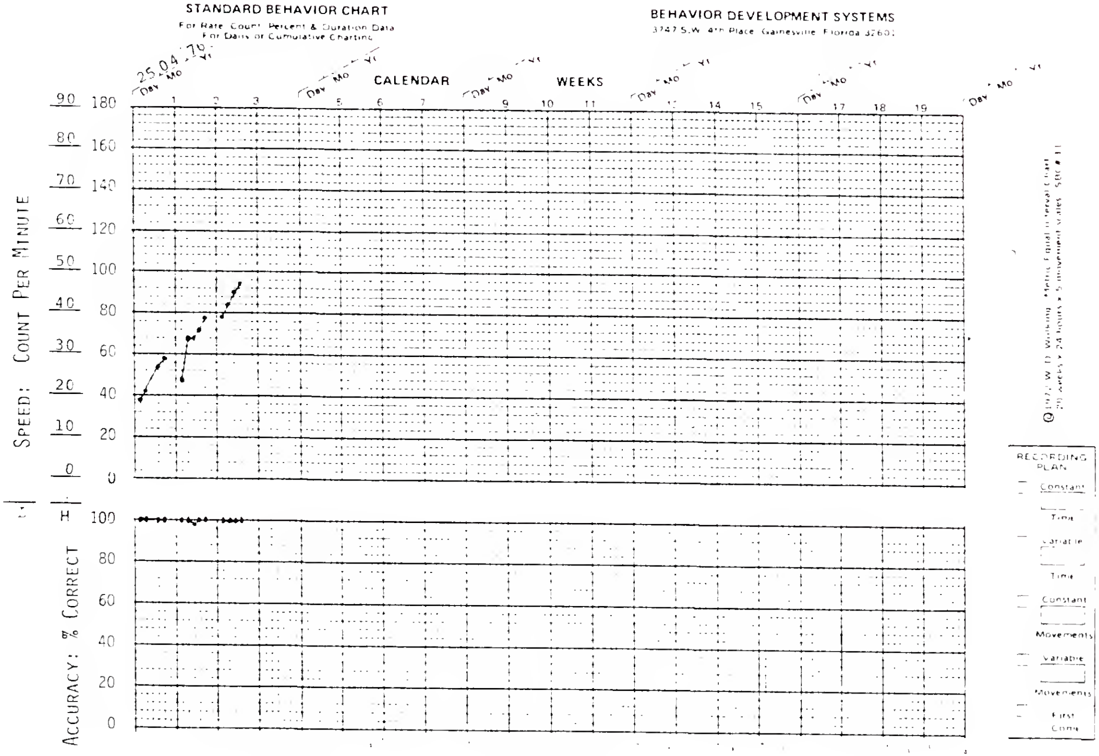
Note. Each subject was given two minutes to complete the task.

[a] Accuracy is defined as number correct divided by total number attempted.

[b] Speed is defined as the total number of attempted behaviors divided by the time.

APPENDIX B

INDIVIDUAL GRAPHIC REPRESENTATIONS



CALENDAR DAYS

PROJECT TEAM

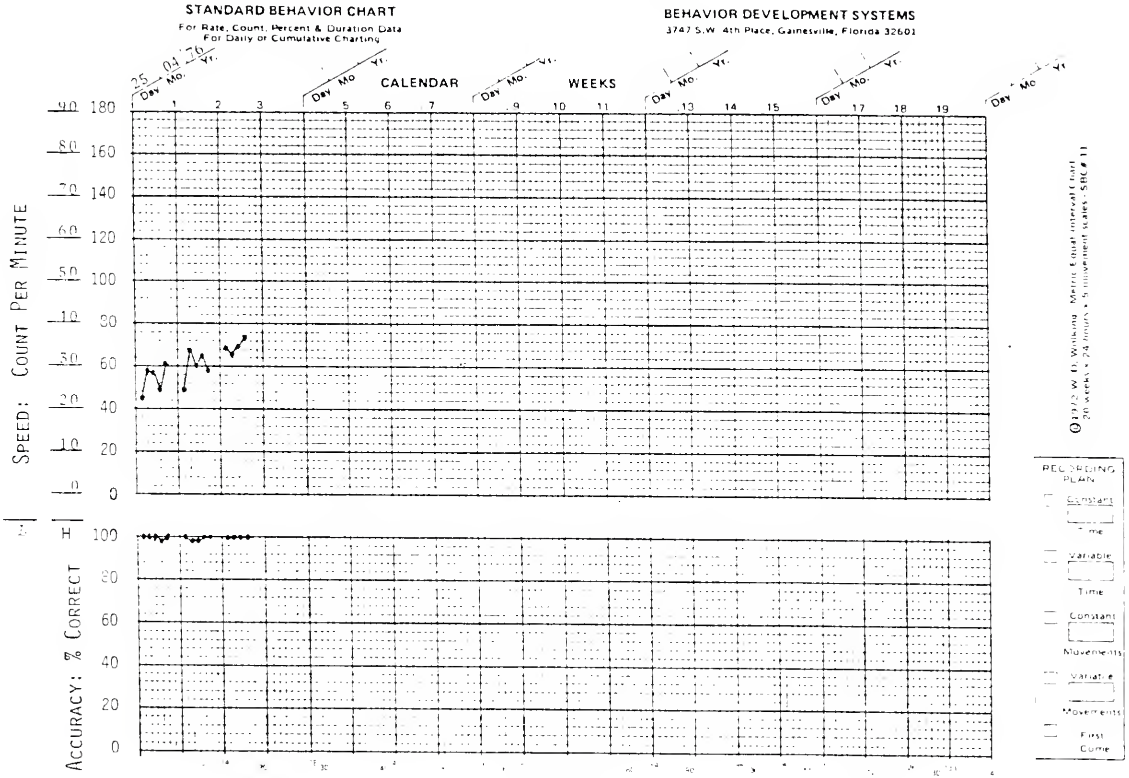
SUPERVISOR Roberta Rubin
ADVISOR
MANAGER
COUNTER Subject 1-C

BEHAVER Subject 1-C
AGE 11 GRADE 5
SCHOOL P.K. Yonge Lab.
TEACHER Jerry Hill
NOTES

MOVEMENT CYCLE

PROJECT BEHAVIOR
COUNT WHEN Sees numbers - writes symbols
COUNT WHEN

Figure B-1. SPEED AND ACCURACY SUMMARY CHART FOR SUBJECT I-C.



PROJECT TEAM

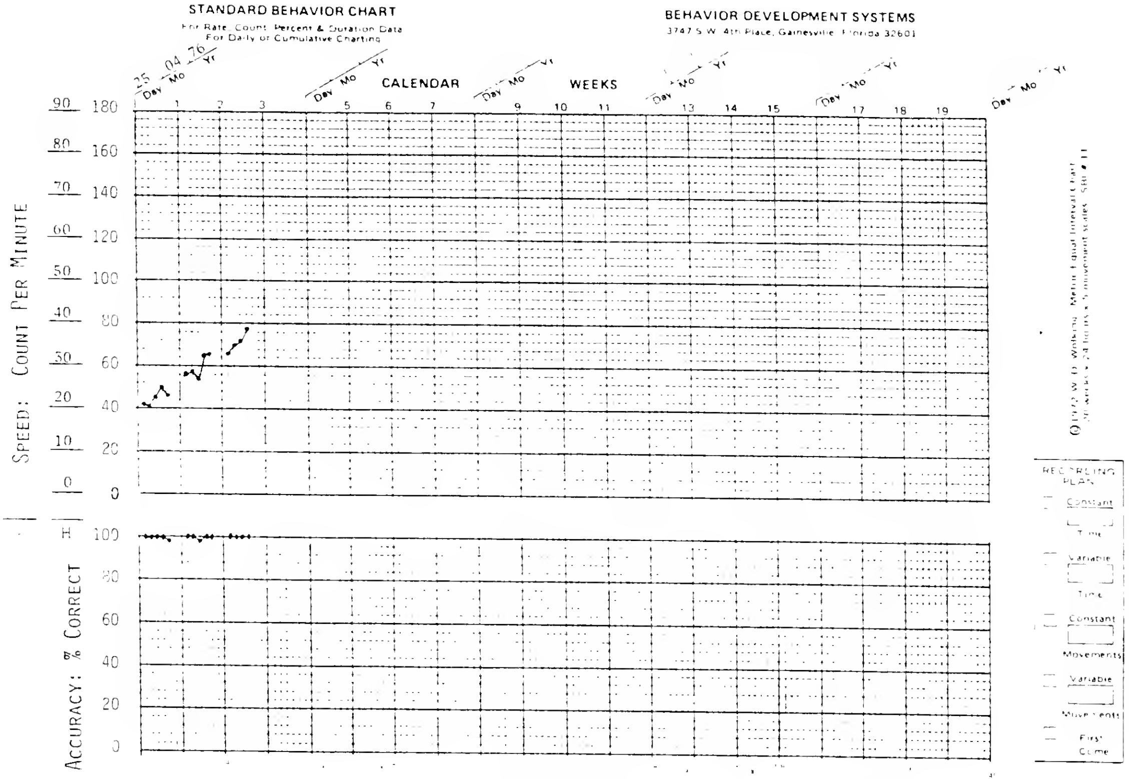
SUPERVISOR Roberta Rubin
ADVISOR
MANAGER
COUNTER Subject 2-C

BEHAVER Subject 2-C
AGE 11 GRADE 5
SCHOOL P.K. Yonge Lab.
TEACHER Jerry Hill
NOTES

MOVEMENT CYCLE

PROJECT BEHAVIOR
COUNT WHEN [·] Sees numbers - writes symbols
COUNT WHEN [x]

Figure B-2. SPEED AND ACCURACY SUMMARY CHART FOR SUBJECT 2-C.



PROJECT TEAM

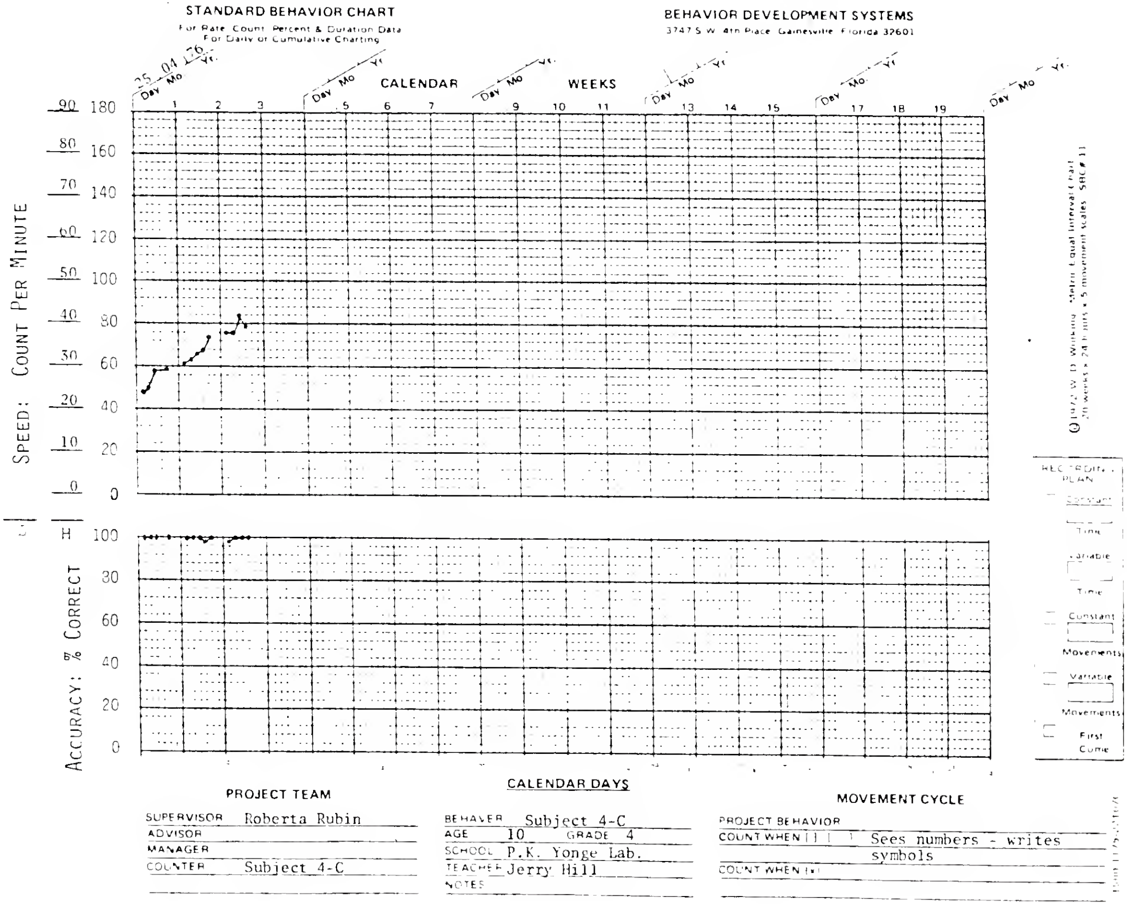
SUPERVISOR Roberta Rubin
ADVISOR
MANAGER
COUNTER Subject 3-C

BEHAVER Subject 3-C
AGE 10 GRADE 5
SCHOOL P.K. Yonge Lab.
TEACHER Barry Gottlieb
NOTES

MOVEMENT CYCLE

PROJECT BEHAVIOR
COUNT WHEN Sees numbers - writes symbols
COUNT WHEN

Figure B-3. SPEED AND ACCURACY SUMMARY CHART FOR SUBJECT 3-C.



PROJECT TEAM

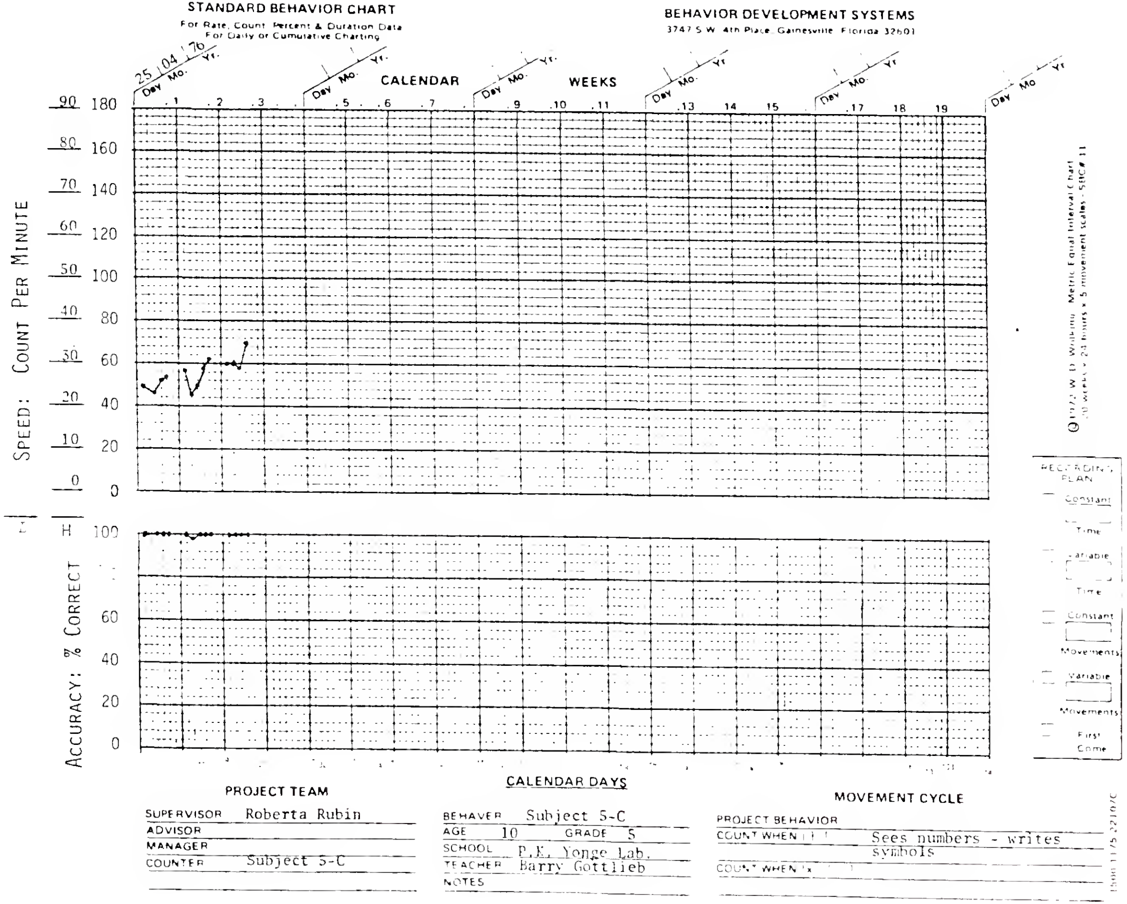
SUPERVISOR Roberta Rubin
ADVISOR
MANAGER
COUNTER Subject 4-C

BEHAVER Subject 4-C
AGE 10 GRADE 4
SCHOOL P.K. Yonge Lab.
TEACHER Jerry Hill
NOTES

MOVEMENT CYCLE

PROJECT BEHAVIOR
COUNT WHEN I I I Sees numbers - writes symbols
COUNT WHEN I I

Figure B-4. SPEED AND ACCURACY SUMMARY CHART FOR SUBJECT 4-C.



PROJECT TEAM

SUPERVISOR Roberta Rubin

ADVISOR

MANAGER

COUNTER Subject 5-C

BEHAVER Subject 5-C

AGE 10 GRADE 5

SCHOOL P.K. Yonge Lab.

TEACHER Barry Gottlieb

NOTES

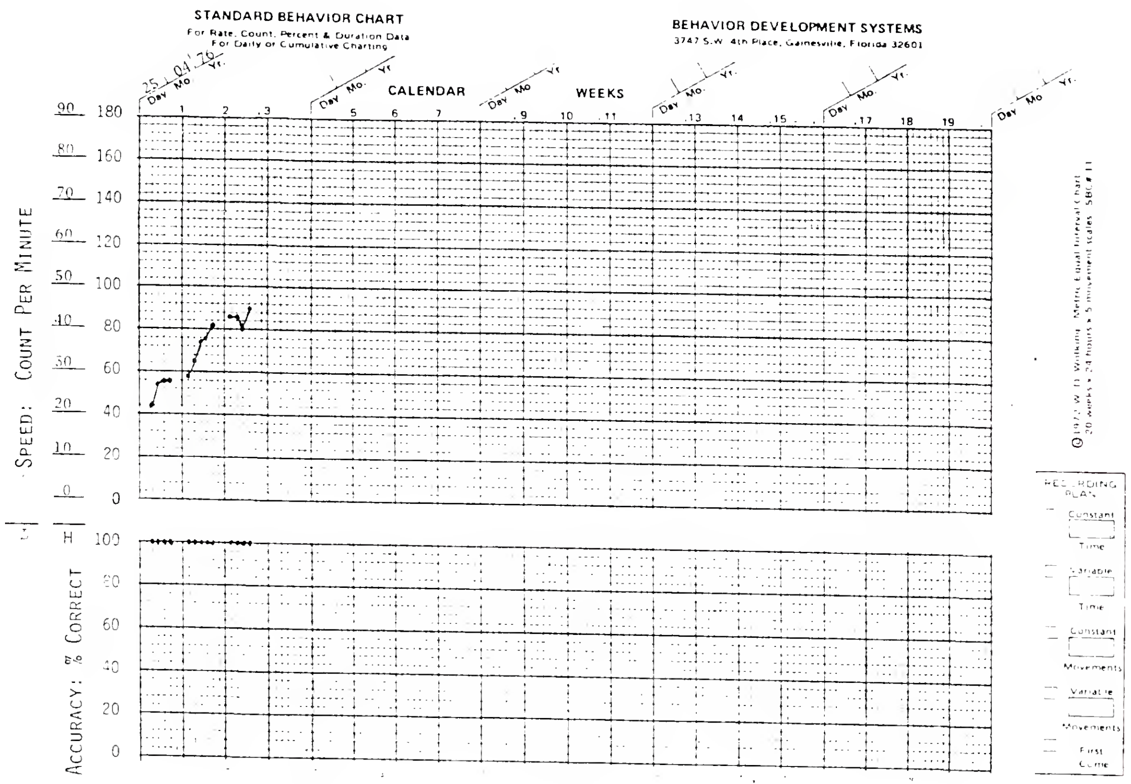
MOVEMENT CYCLE

PROJECT BEHAVIOR

COUNT WHEN Sees numbers - writes symbols

COUNT WHEN

Figure B-5. SPEED AND ACCURACY SUMMARY CHART FOR SUBJECT 5-C.



CALENDAR DAYS

PROJECT TEAM

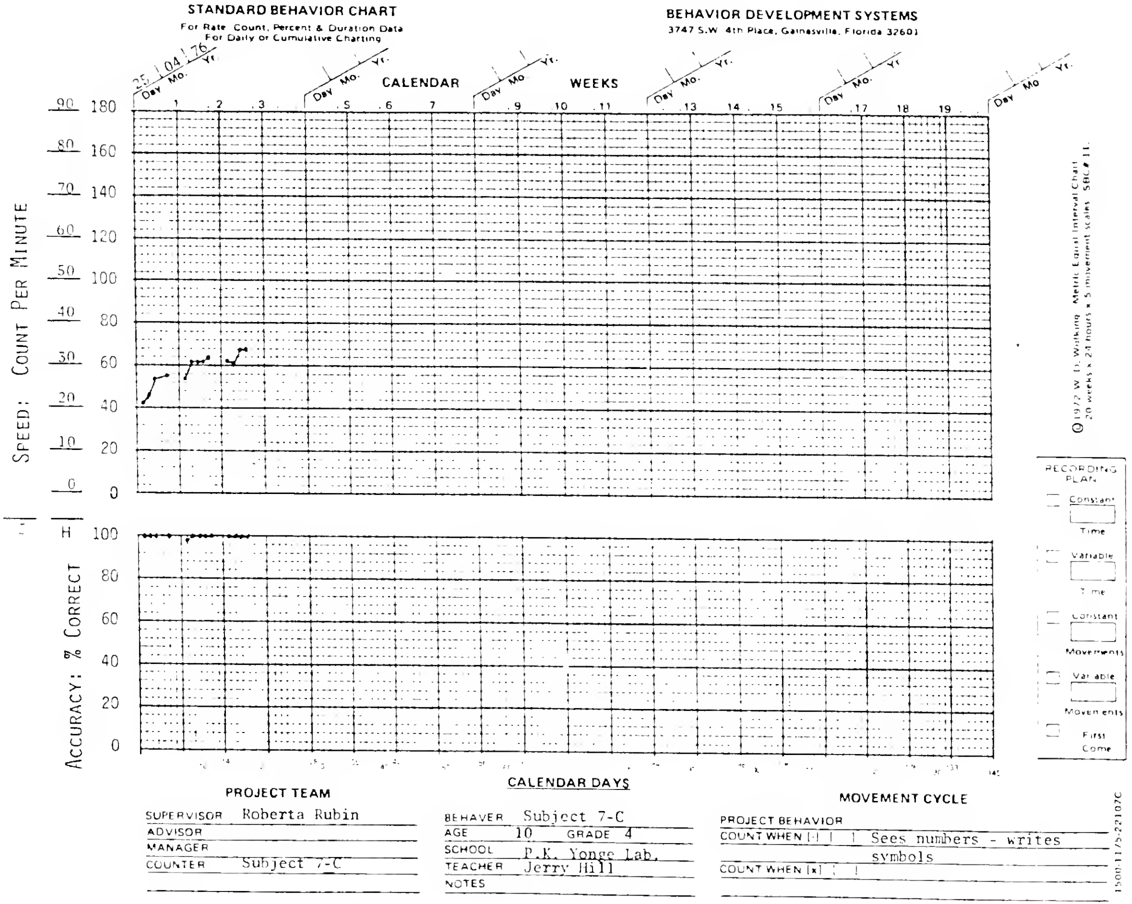
SUPERVISOR Roberta Rubin
ADVISOR
MANAGER
COUNTER Subject 6-C

BEHAVER Subject 6-C
AGE 10 GRADE 5
SCHOOL P.K. Yonge Lab.
TEACHER Jerry Hill
NOTES

MOVEMENT CYCLE

PROJECT BEHAVIOR
COUNT WHEN Sees numbers - writes symbols
COUNT WHEN

Figure B-6. SPEED AND ACCURCY SUMMARY CHART FOR SUBJECT 6-C.



PROJECT TEAM

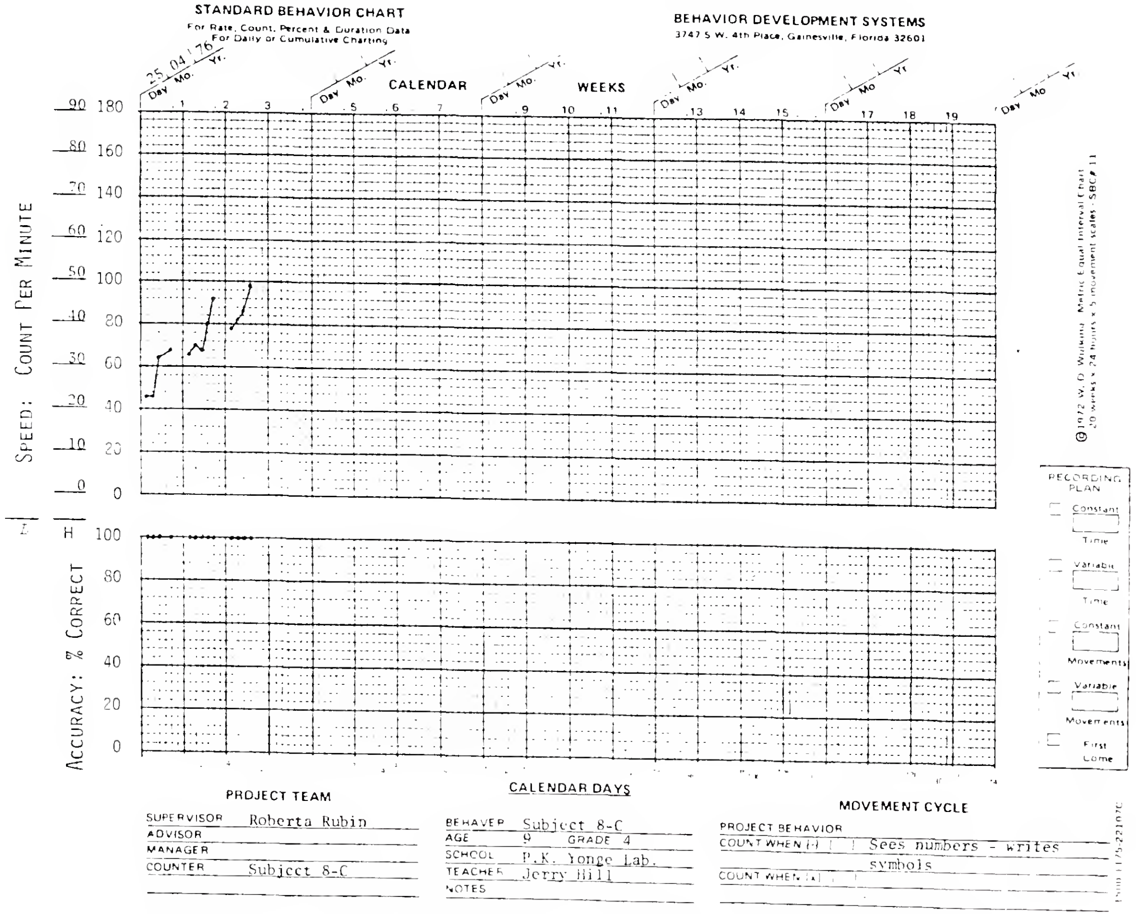
SUPERVISOR Roberta Rubin
ADVISOR
MANAGER
COUNTER Subject 7-C

BEHAVER Subject 7-C
AGE 10 GRADE 4
SCHOOL P.K. Yonge Lab.
TEACHER Jerry Hill
NOTES

MOVEMENT CYCLE

PROJECT BEHAVIOR
COUNT WHEN [·] Sees numbers - writes symbols
COUNT WHEN [x]

Figure B-7. SPEED AND ACCURACY SUMMARY CHART FOR SUBJECT 7-C.

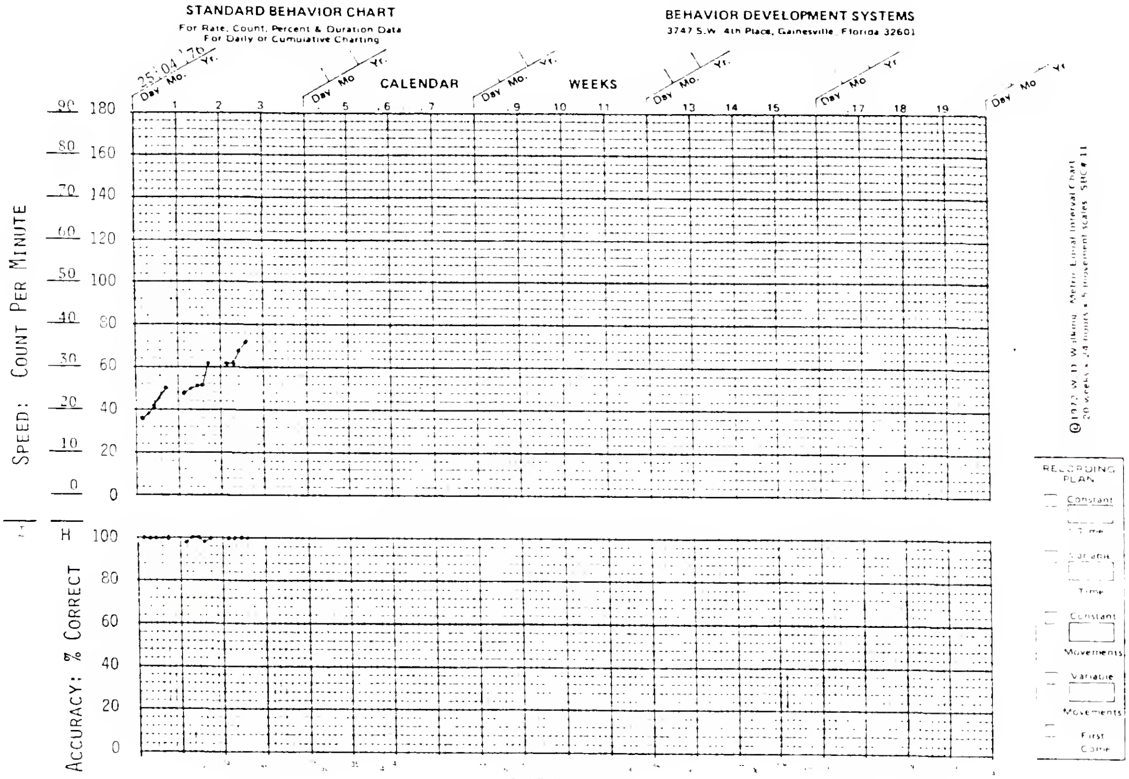


SUPERVISOR Roberta Rubin
ADVISOR
MANAGER
COUNTER Subject 8-C

BEHAVER Subject 8-C
AGE 9 GRADE 4
SCHOOL P.K. Yonge Lab.
TEACHER Jerry Hill
NOTES

PROJECT BEHAVIOR
COUNT WHEN (·) Sees numbers - writes symbols
COUNT WHEN (x)

Figure B-8. SPEED AND ACCURACY SUMMARY CHART FOR SUBJECT 8-C.



PROJECT TEAM

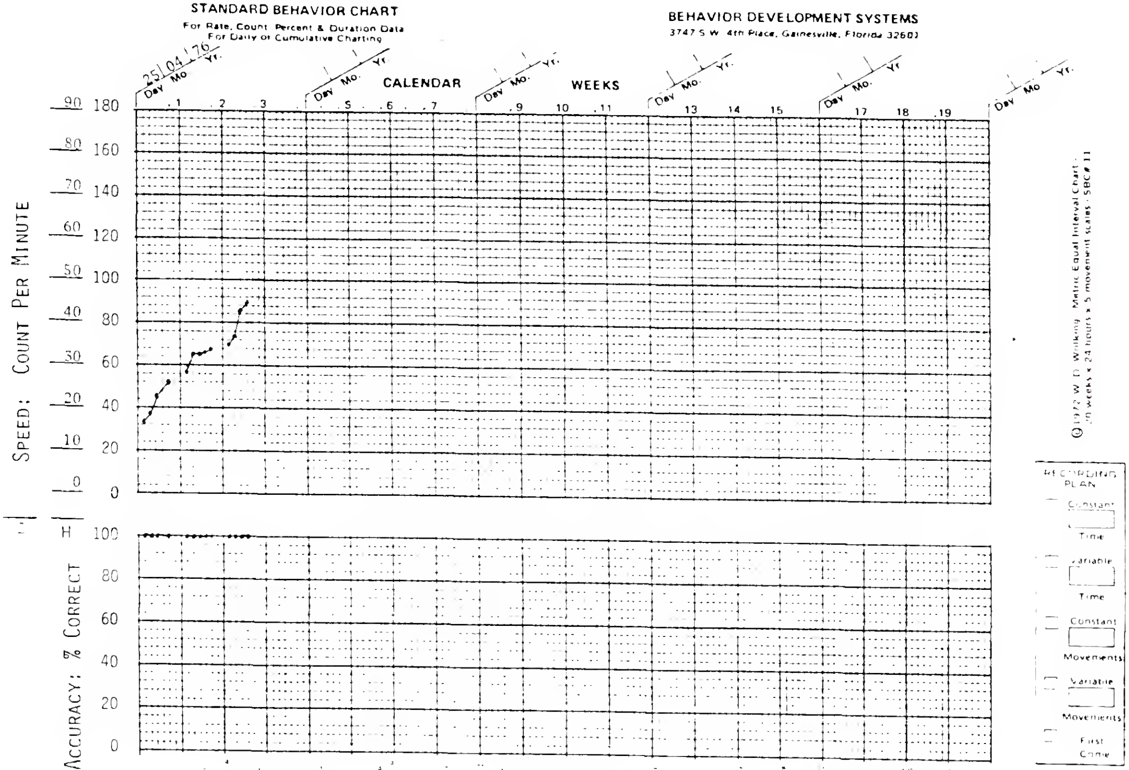
SUPERVISOR Roberta Rubin
ADVISOR
MANAGER
COUNTER Subject 9-C

BEHAVER Subject 9-C
AGE 9 GRADE 4
SCHOOL P.K. Yonge Lab.
TEACHER Barry Gottlieb
NOTES

MOVEMENT CYCLE

PROJECT BEHAVIOR
COUNT WHEN [ ] Sees numbers - writes symbols
COUNT WHEN [x]

Figure B-9. SPEED AND ACCURACY SUMMARY CHART FOR SUBJECT 9-C.



PROJECT TEAM

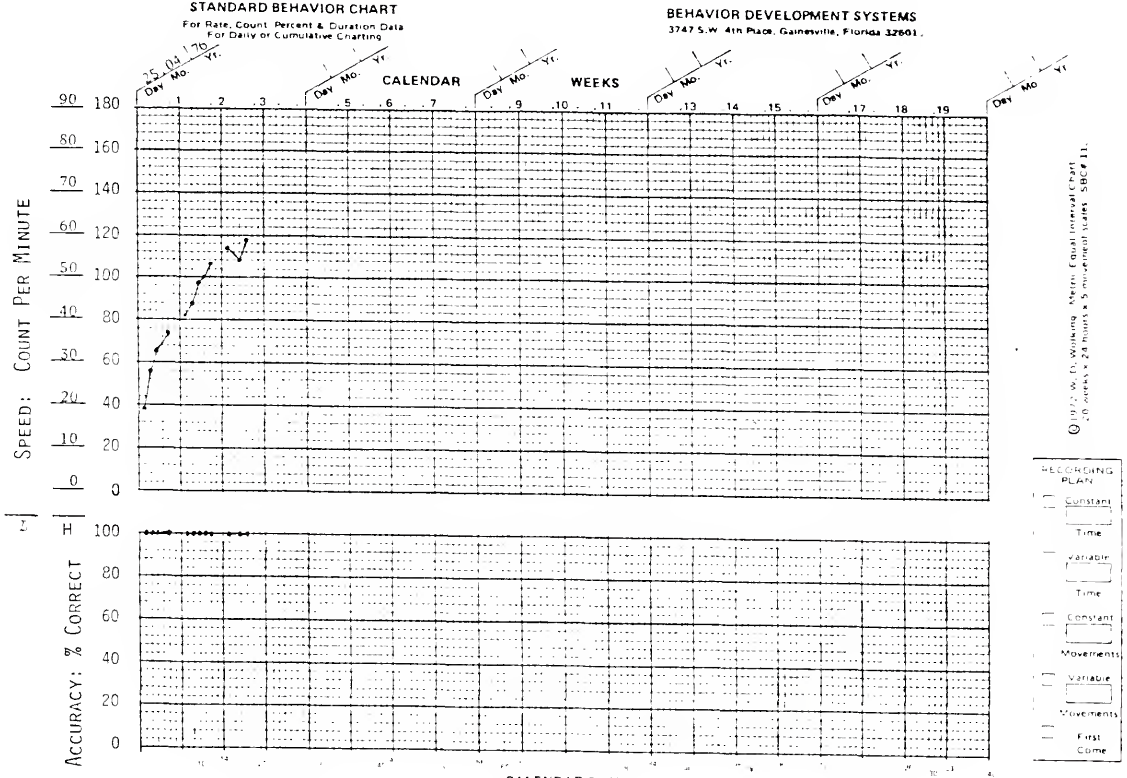
SUPERVISOR Roberta Rubin
ADVISOR
MANAGER
COUNTER Subject 11-SBC

BEHAVER Subject 11-SBC
AGE 10 GRADE 5
SCHOOL P.K. Yonge Lab.
TEACHER Jerry Hill
NOTES

MOVEMENT CYCLE

PROJECT BEHAVIOR
COUNT WHEN (+) Sees numbers - writes symbols
COUNT WHEN (x)

Figure B-10. SPEED AND ACCURACY SUMMARY CHART FOR SUBJECT 11-SBC.



PROJECT TEAM

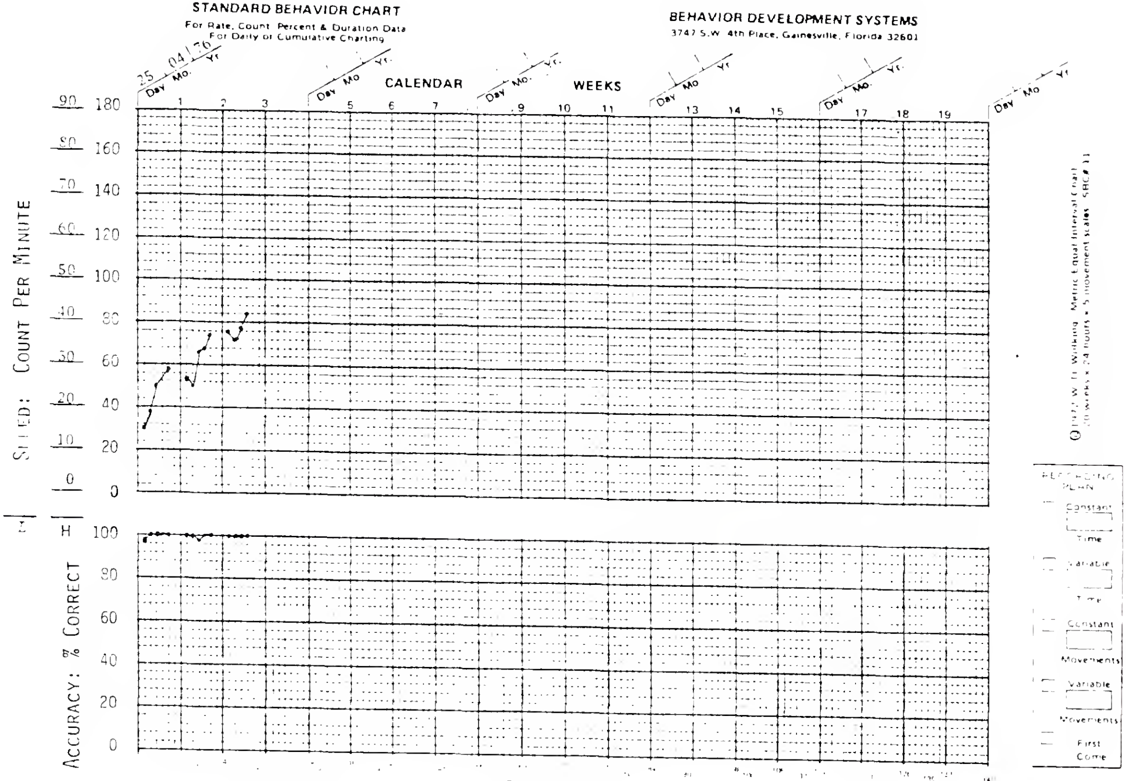
SUPERVISOR Roberta Rubin
ADVISOR
MANAGER
COUNTER Subject 12-SBC

BEHAVER Subject 12-SBC
AGE 10 GRADE 4
SCHOOL P.K. Yonge Lab.
TEACHER Barry Gottlieb
NOTES

MOVEMENT CYCLE

PROJECT BEHAVIOR
COUNT WHEN (✓) ( ) Sees numbers - writes symbols
COUNT WHEN (x)

Figure B-11. SPEED AND ACCURACY SUMMARY CHART FOR SUBJECT 12-SBC.



PROJECT TEAM

SUPERVISOR Roberta Rubin
ADVISOR
MANAGER
COUNTER Subject 13-SBC

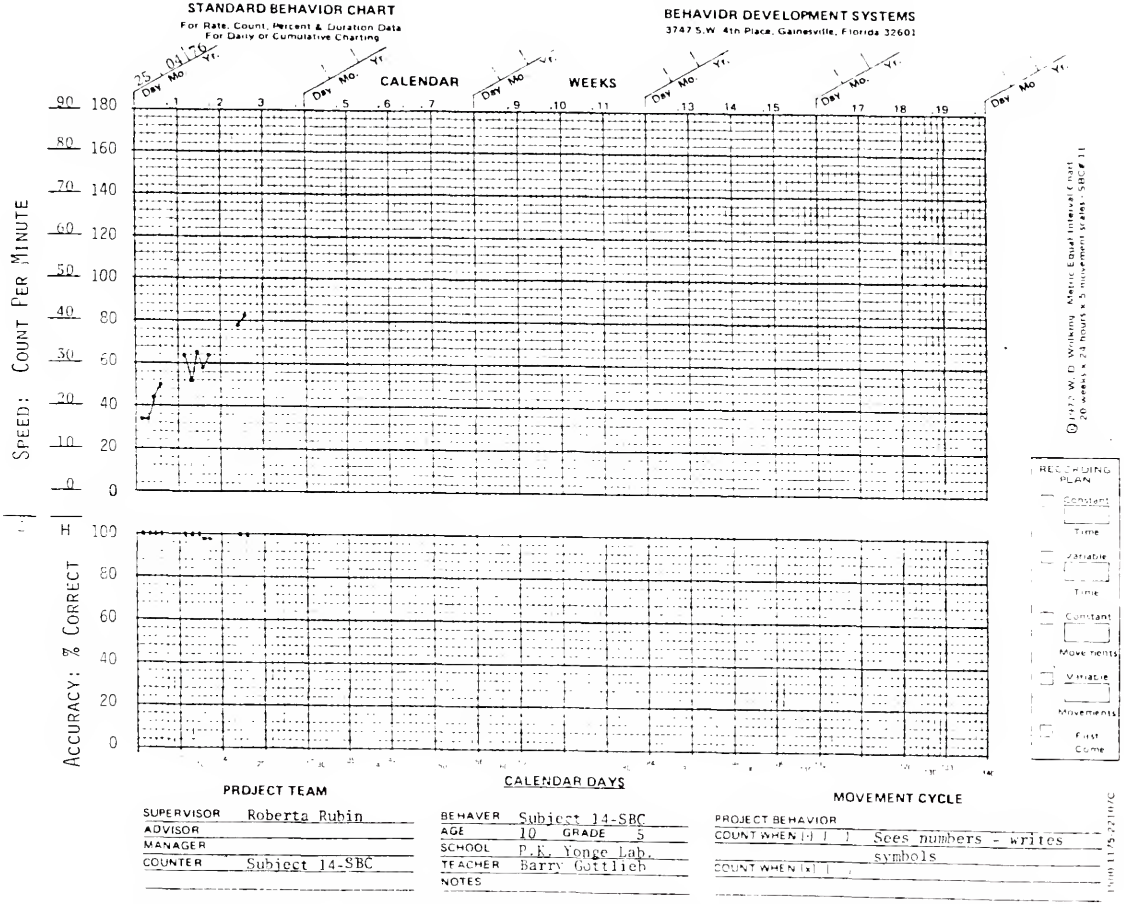
CALENDAR DAYS

BEHAVER Subject 13-SBC
AGE 10 GRADE 4
SCHOOL P.K. Yonge Lab.
TEACHER Barry Gottlieb
NOTES

MOVEMENT CYCLE

PROJECT BEHAVIOR
COUNT WHEN [·] Sees numbers - writes symbols
COUNT WHEN [x]

Figure B-12. SPEED AND ACCURACY SUMMARY CHART FOR SUBJECT 13-SBC.



PROJECT TEAM

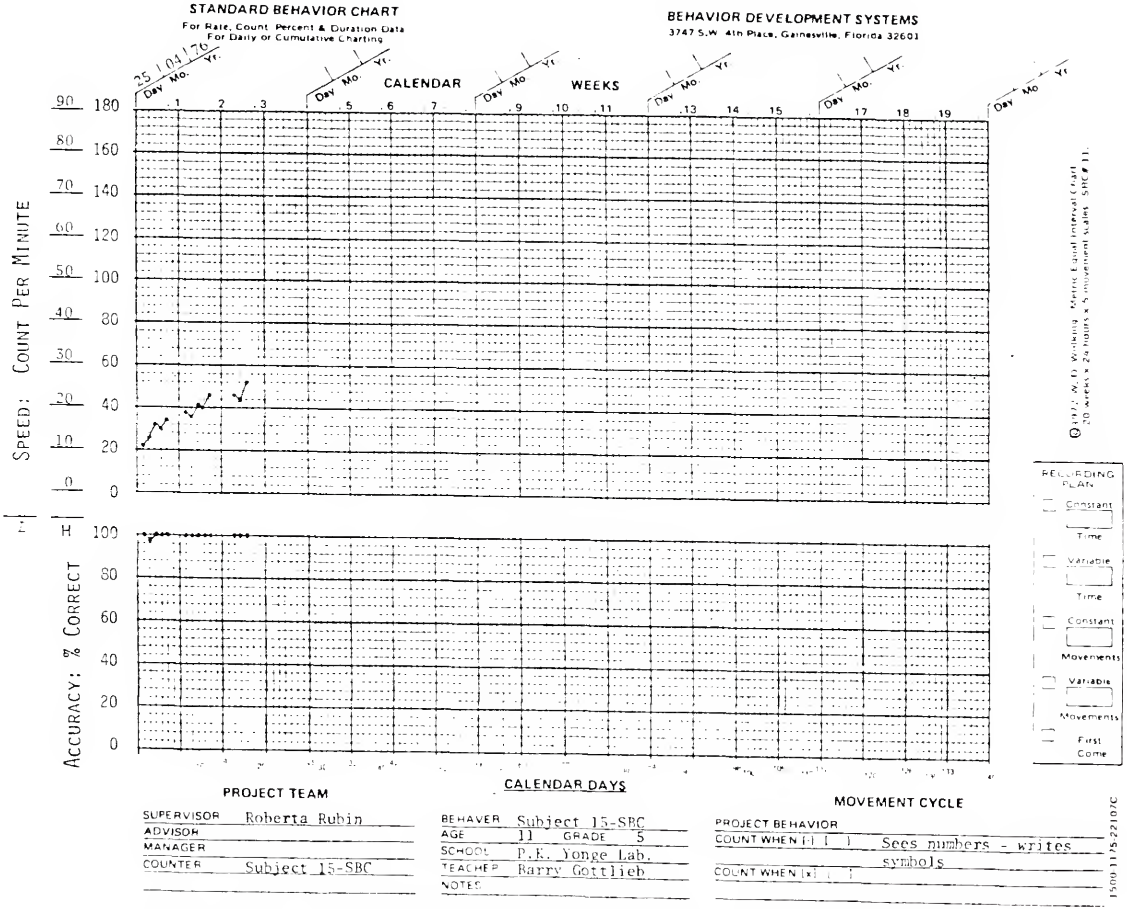
SUPERVISOR Roberta Rubin
ADVISOR
MANAGER
COUNTER Subject 14-SBC

BEHAVER Subject 14-SBC
AGE 10 GRADE 5
SCHOOL P.K. Yonge Lab.
TEACHER Barry Gottlieb
NOTES

MOVEMENT CYCLE

PROJECT BEHAVIOR
COUNT WHEN (·) Sees numbers - writes symbols
COUNT WHEN (x)

Figure B-13. SPEED AND ACCURACY SUMMARY CHART FOR SUBJECT 14-SBC.



PROJECT TEAM

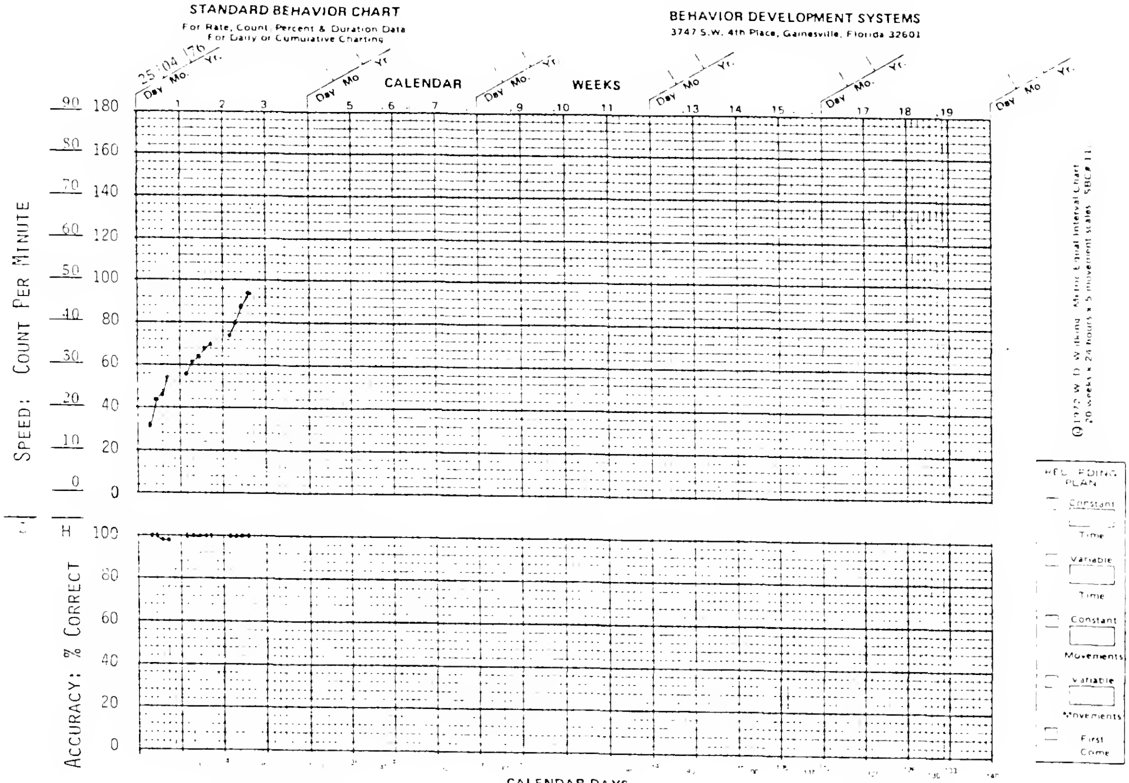
SUPERVISOR Roberta Rubin
ADVISOR
MANAGER
COUNTER Subject 15-SBC

BEHAVER Subject 15-SBC
AGE 11 GRADE 5
SCHOOL P.K. Yonge Lab.
TEACHER Barry Gottlieb
NOTES

MOVEMENT CYCLE

PROJECT BEHAVIOR
COUNT WHEN [·] [ ] Sees numbers - writes symbols
COUNT WHEN [x] [ ]

Figure B-14. SPEED AND ACCURACY SUMMARY CHART FOR SUBJECT 15-SBC.



PROJECT TEAM

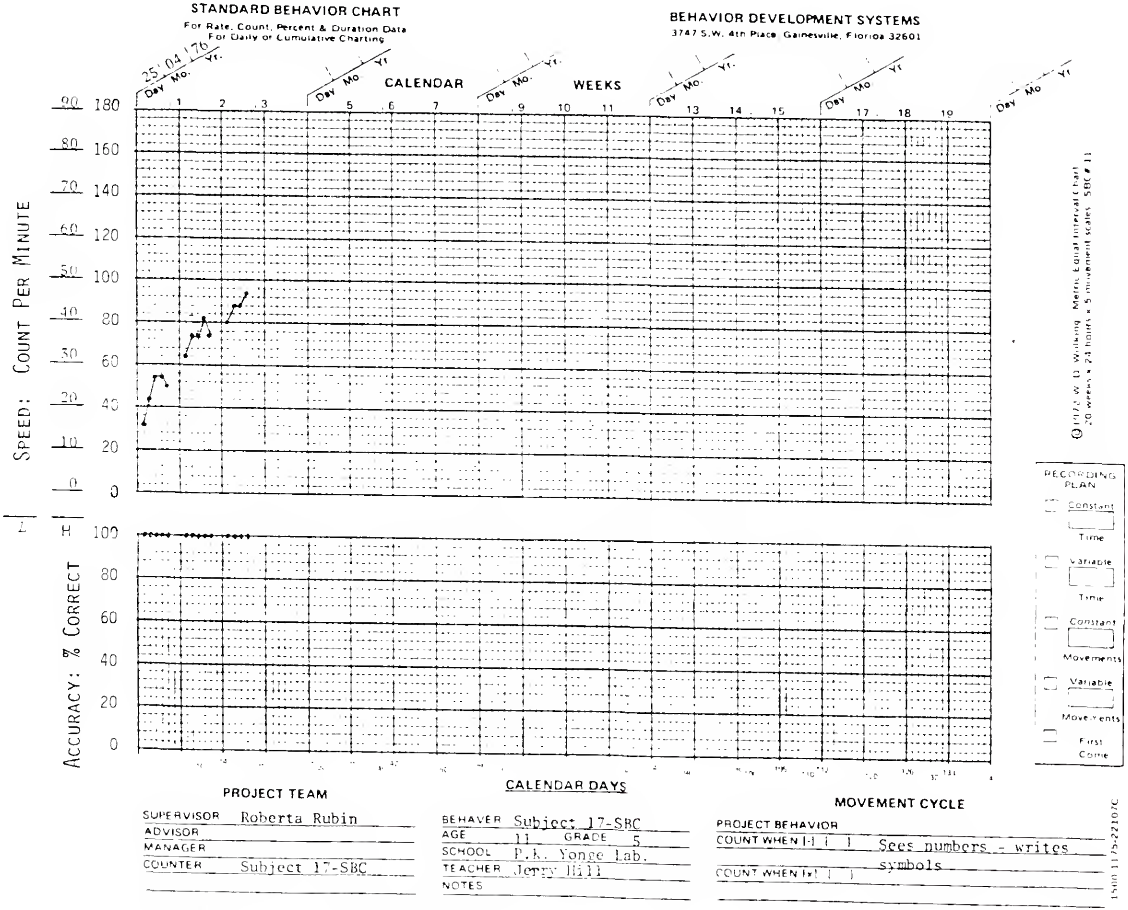
SUPERVISOR Roberta Rubin
ADVISOR
MANAGER
COUNTER Subject 16-SBC

BEHAVER Subject 16-SBC
AGE 10 GRADE 5
SCHOOL P.K. Yonge Lab.
TEACHER Barry Gottlieb
NOTES

MOVEMENT CYCLE

PROJECT BEHAVIOR
COUNT WHEN ( ) Sees numbers - writes symbols
COUNT WHEN (x)

Figure B-15. SPEED AND ACCURACY SUMMARY CHART FOR SUBJECT 16-SBC.



PROJECT TEAM

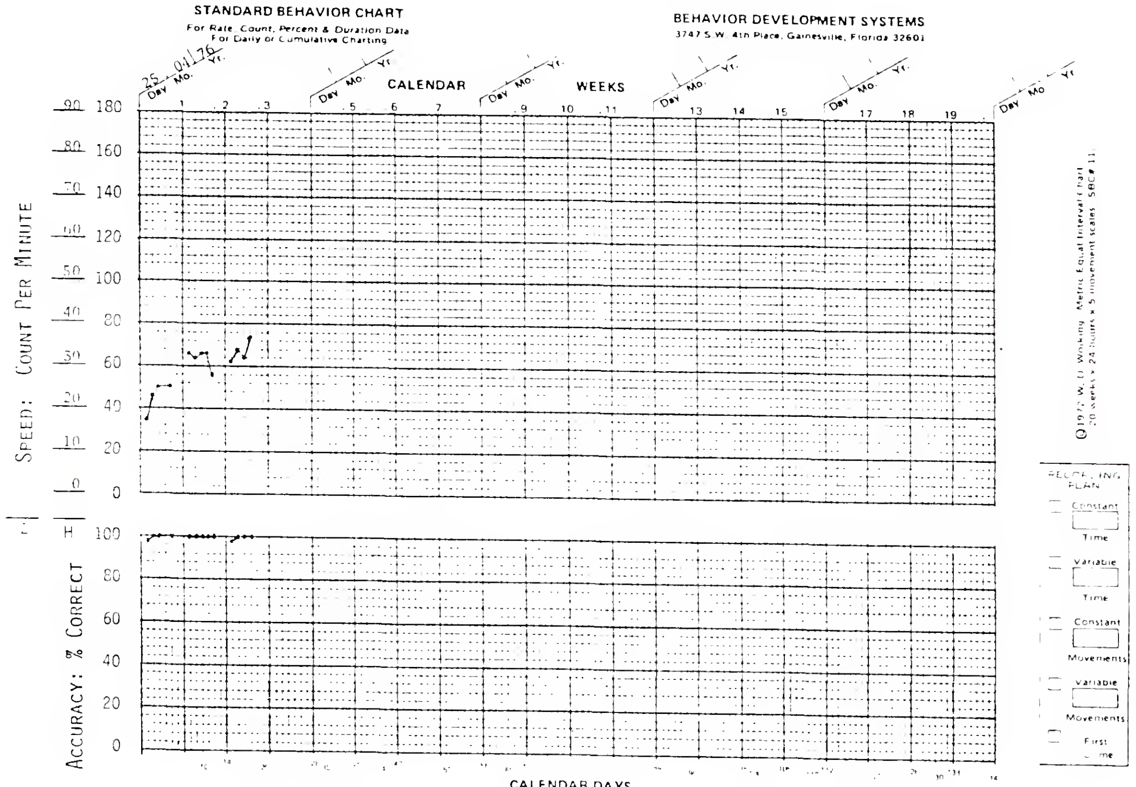
SUPERVISOR Roberta Rubin
ADVISOR
MANAGER
COUNTER Subject 17-SBC

BEHAVER Subject 17-SBC
AGE 11 GRADE 5
SCHOOL P.K. Yonge Lab.
TEACHER Jerry Hill
NOTES

MOVEMENT CYCLE

PROJECT BEHAVIOR
COUNT WHEN [-] [ ] Sees numbers - writes symbols
COUNT WHEN [x] [ ]

Figure B-16. SPEED AND ACCURACY SUMMARY CHART FOR SUBJECT 17-SBC.



PROJECT TEAM

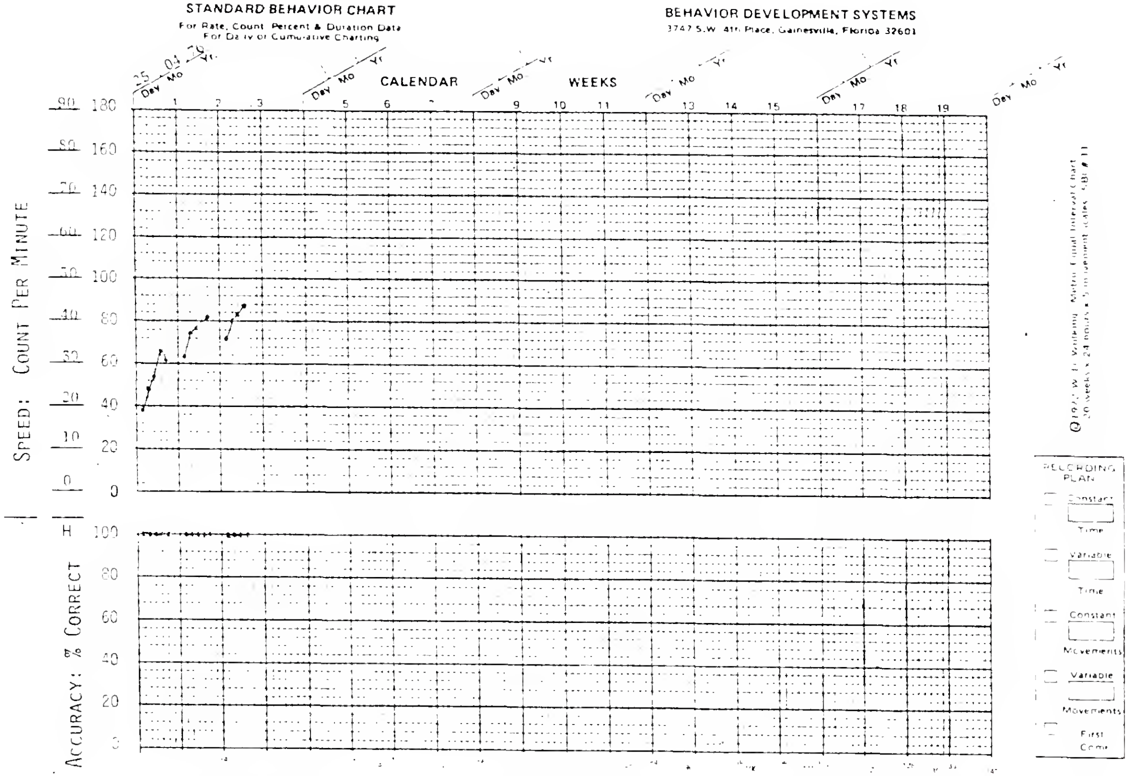
SUPERVISOR Roberta Rubin
ADVISOR
MANAGER
COUNTER Subject 19-SBC

BEHAVER Subject 19-SBC
AGE 10 GRADE 4
SCHOOL P.K. Yonge Lab.
TEACHER Barry Gottlieb
NOTES

MOVEMENT CYCLE

PROJECT BEHAVIOR
COUNT WHEN Sees numbers - writes symbols
COUNT WHEN

Figure B-17. SPEED AND ACCURACY SUMMARY CHART FOR SUBJECT 19-SBC.



PROJECT TEAM

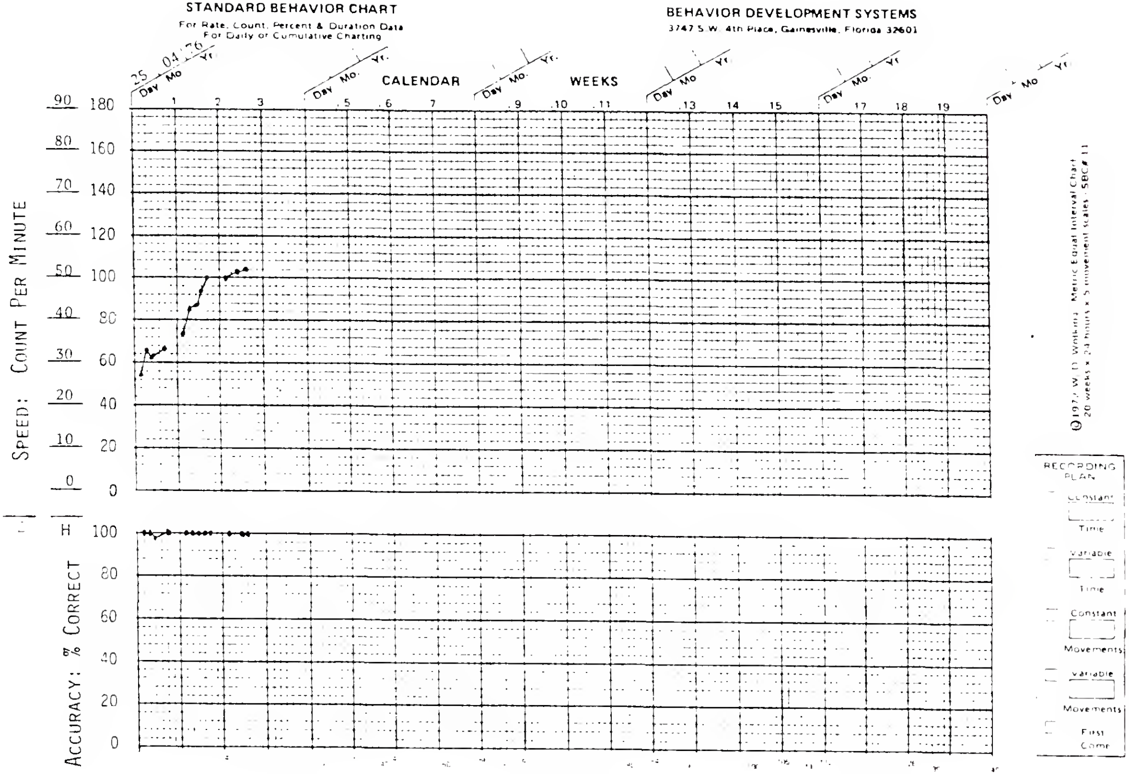
SUPERVISOR Roberta Rubin
ADVISOR
MANAGER
COUNTER Subject 20-SBC

BEHAVER Subject 20-SBC
AGE 11 GRADE 5
SCHOOL P.K. Yonge Lab.
TEACHER Jerry Hill
NOTES

MOVEMENT CYCLE

PROJECT BEHAVIOR
COUNT WHEN I Sees numbers - writes symbols
COUNT WHEN IX

Figure B-18. SPEED AND ACCURACY SUMMARY CHART FOR SUBJECT 20-SBC.



PROJECT TEAM

SUPERVISOR Roberta Rubin
ADVISOR
MANAGER
COUNTER Subject 21-RSR

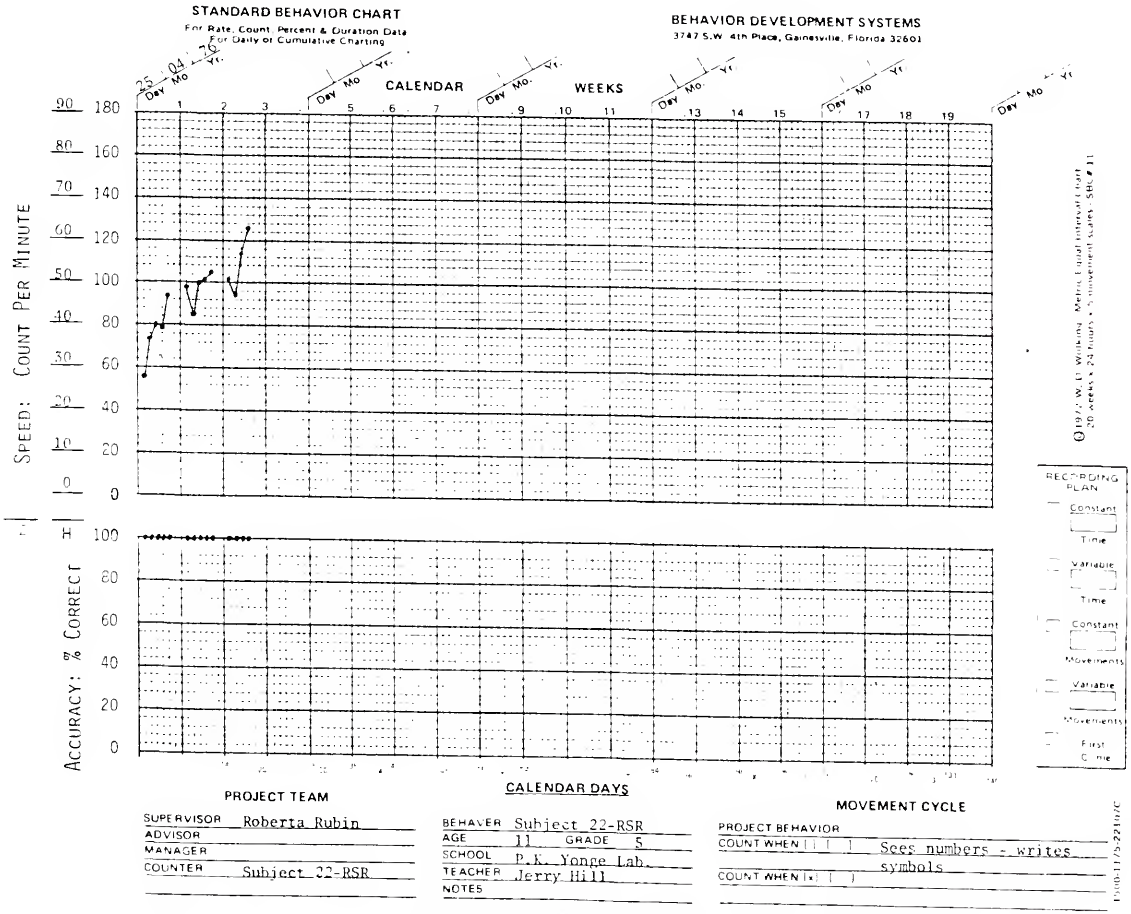
BEHAVER Subject 21-RSR
AGE 9 GRADE 4
SCHOOL P.K. Yonge Lab.
TEACHER Barry Gottlieb
NOTES

MOVEMENT CYCLE

PROJECT BEHAVIOR
COUNT WHEN ( ) Sees numbers - writes symbols
COUNT WHEN (x)

1500 1175-2210/C

Figure B-19. SPEED AND ACCURACY SUMMARY CHART FOR SUBJECT 21-RSR.



PROJECT TEAM

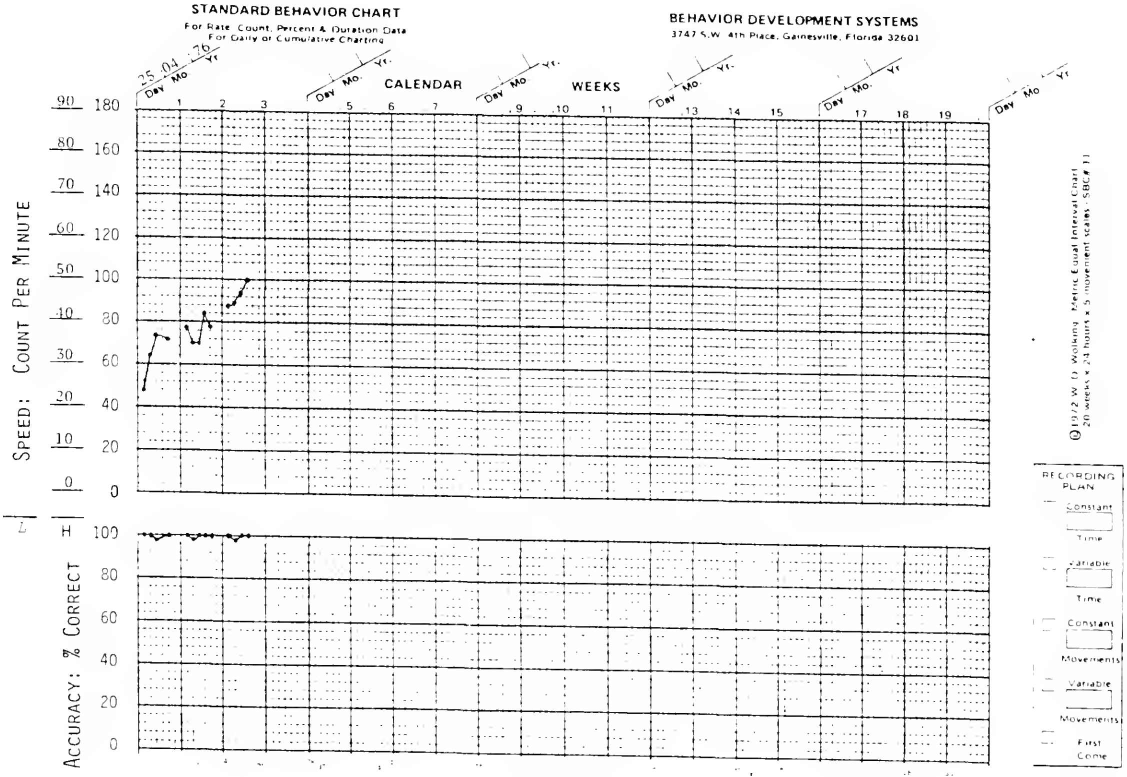
SUPERVISOR Roberta Rubin
ADVISOR
MANAGER
COUNTER Subject 22-RSR

BEHAVER Subject 22-RSR
AGE 11 GRADE 5
SCHOOL P.K. Yonge Lab.
TEACHER Jerry Hill
NOTES

MOVEMENT CYCLE

PROJECT BEHAVIOR
COUNT WHEN ☐ ☐ ☐ Sees numbers - writes symbols
COUNT WHEN ☒ ☐ ☐

Figure B-20. SPEED AND ACCURACY SUMMARY CHART FOR SUBJECT 22-RSR.



CALENDAR DAYS

PROJECT TEAM

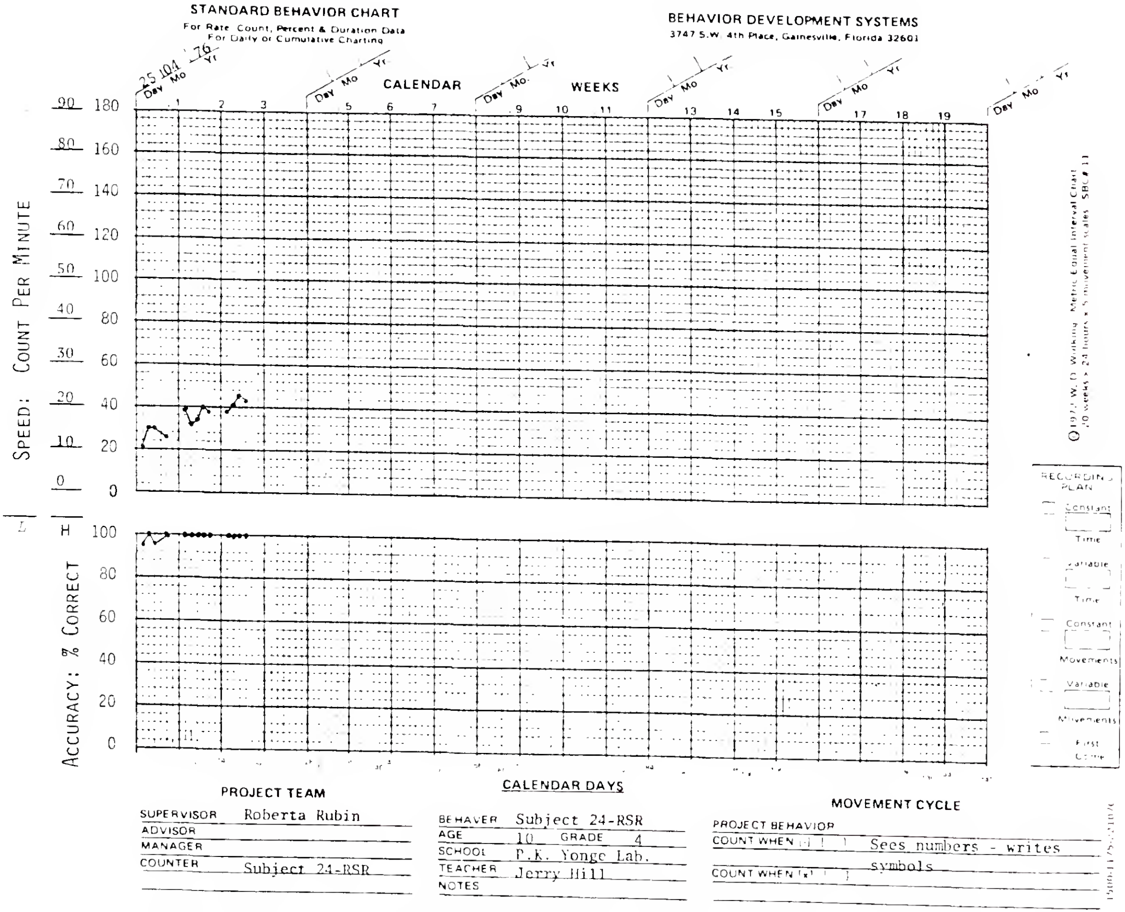
SUPERVISOR Roberta Rubin
ADVISOR
MANAGER
COUNTER Subject 23-RSR

BEHAVER Subject 23-RSR
AGE 10 GRADE 4
SCHOOL P.K. Yonge Lab.
TEACHER Jerry Hill
NOTES

MOVEMENT CYCLE

PROJECT BEHAVIOR
COUNT WHEN (✓) Sees numbers - writes symbols
COUNT WHEN (x)

Figure B-21. SPEED AND ACCURACY SUMMARY CHART FOR SUBJECT 23-RSR.

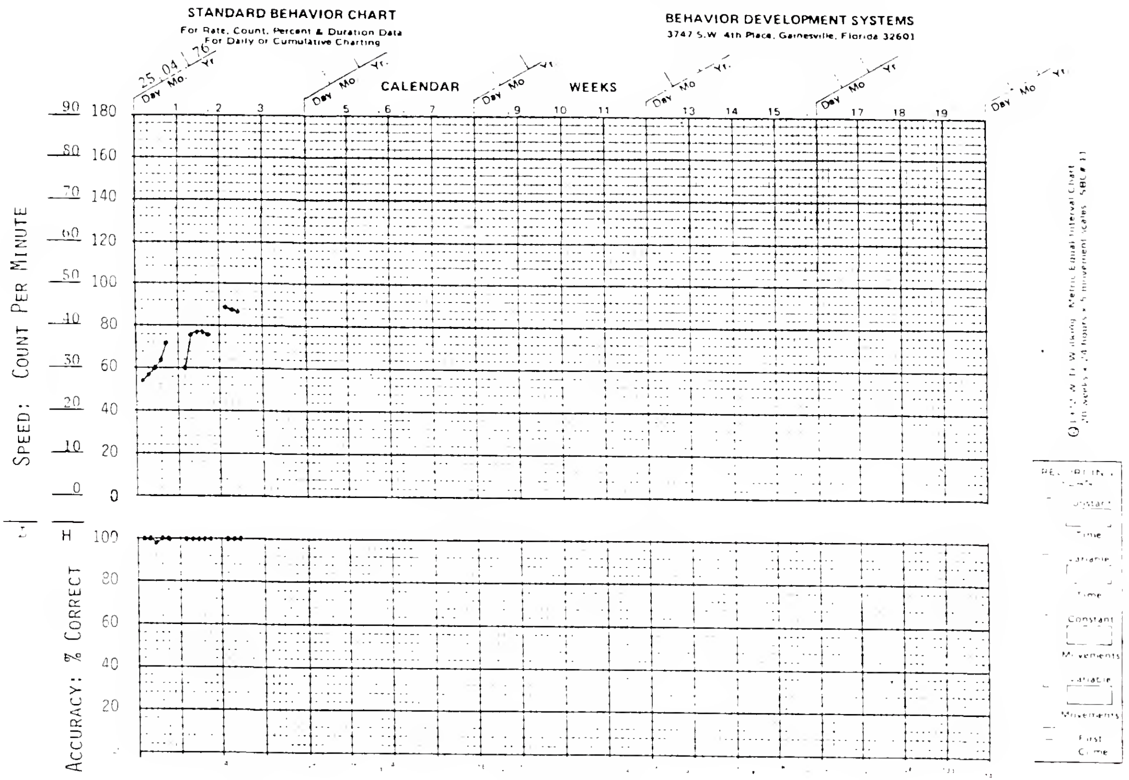


SUPERVISOR Roberta Rubin
ADVISOR
MANAGER
COUNTER Subject 24-RSR

BEHAVER Subject 24-RSR
AGE 10 GRADE 4
SCHOOL P.K. Yonge Lab.
TEACHER Jerry Hill
NOTES

PROJECT BEHAVIOR
COUNT WHEN Sees numbers - writes symbols
COUNT WHEN

Figure B-22. SPEED AND ACCURACY SUMMARY CHART FOR SUBJECT 24-RSR.



PROJECT TEAM

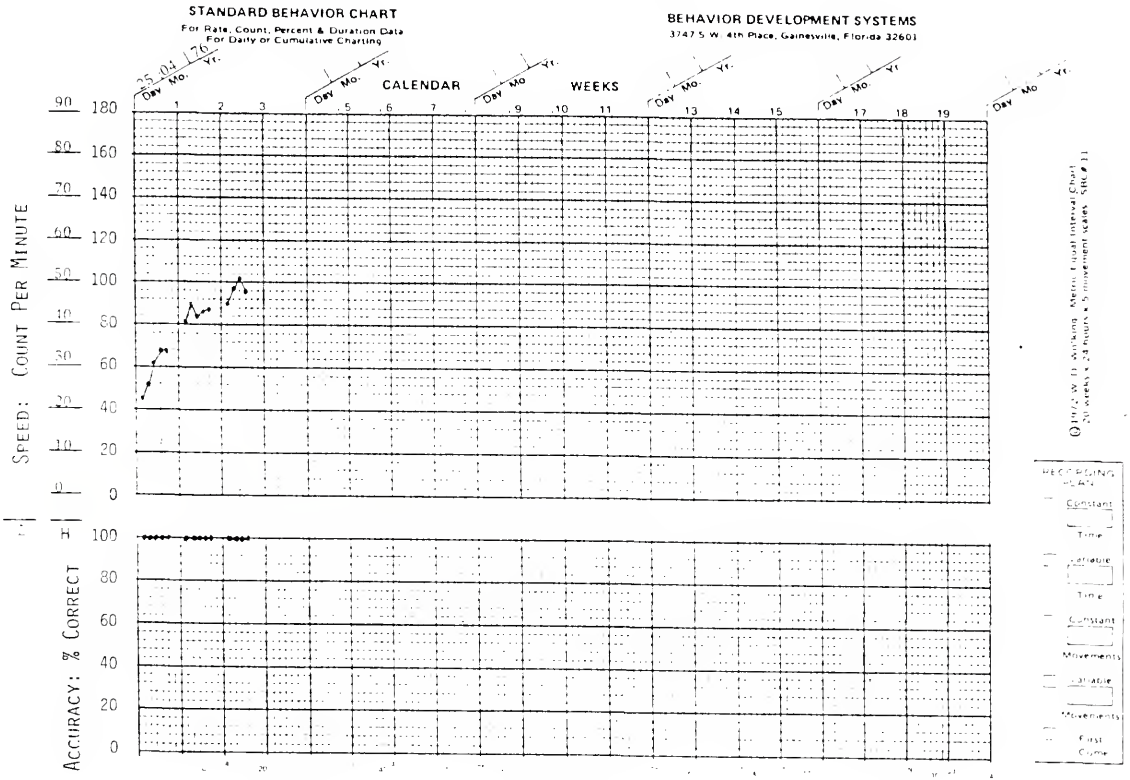
SUPERVISOR Roberta Rubin
ADVISOR
MANAGER
COUNTER Subject 25-RSR

BEHAVER Subject 25-RSR
AGE 10 GRADE 5
SCHOOL P.K. Yonge Lab.
TEACHER Barry Gottlieb
NOTES

MOVEMENT CYCLE

PROJECT BEHAVIOR
COUNT WHEN [·] Sees numbers - writes symbols
COUNT WHEN [x]

Figure B-23. SPEED AND ACCURACY SUMMARY CHART FOR SUBJECT 25-RSR.



PROJECT TEAM

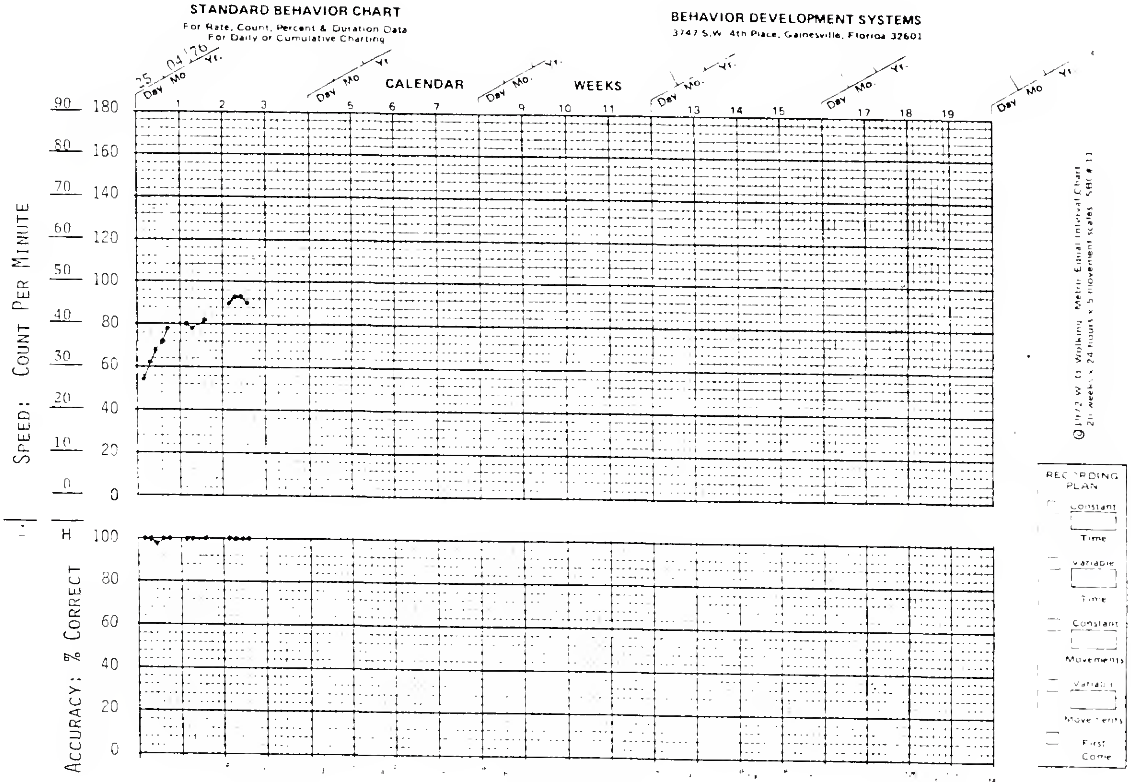
SUPERVISOR Roberta Rubin
ADVISOR
MANAGER
COUNTER Subject 26-RSR

BEHAVER Subject 26-RSR
AGE 11 GRADE 5
SCHOOL P.K. Yonge Lab.
TEACHER Barry Gottlieb
NOTES

MOVEMENT CYCLE

PROJECT BEHAVIOR
COUNT WHEN Sees numbers - writes symbols
COUNT WHEN

Figure B-24. SPEED AND ACCURACY SUMMARY CHART FOR SUBJECT 26-RSR.



CALENDAR DAYS

PROJECT TEAM

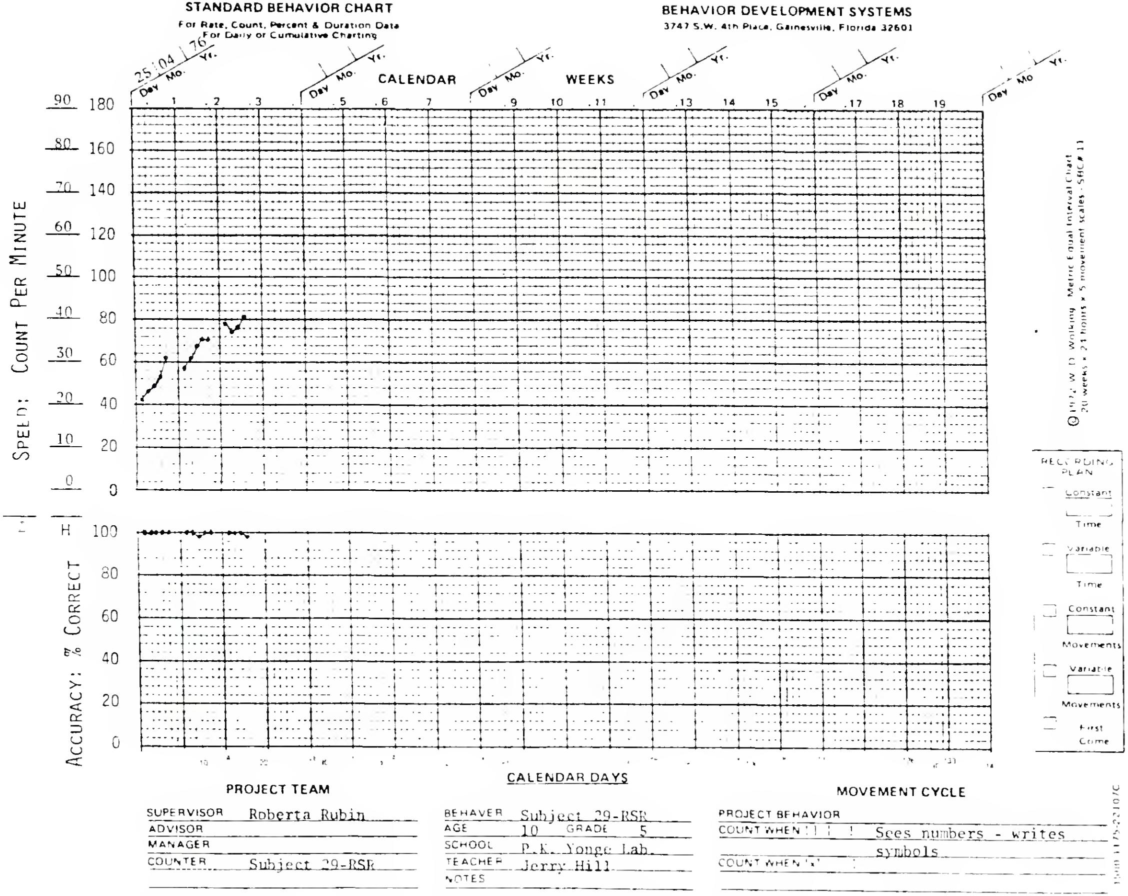
SUPERVISOR Roberta Rubin
ADVISOR
MANAGER
COUNTER Subject 28-RSR

BEHAVER Subject 28-RSR
AGE 11 GRADE 5
SCHOOL P.K. Yonge Lab.
TEACHER Barry Gottlieb
NOTES

MOVEMENT CYCLE

PROJECT BEHAVIOR
COUNT WHEN [ ] Sees numbers - writes symbols
COUNT WHEN [x]

Figure B-25. SPEED AND ACCURACY SUMMARY CHART FOR SUBJECT 28-RSR.

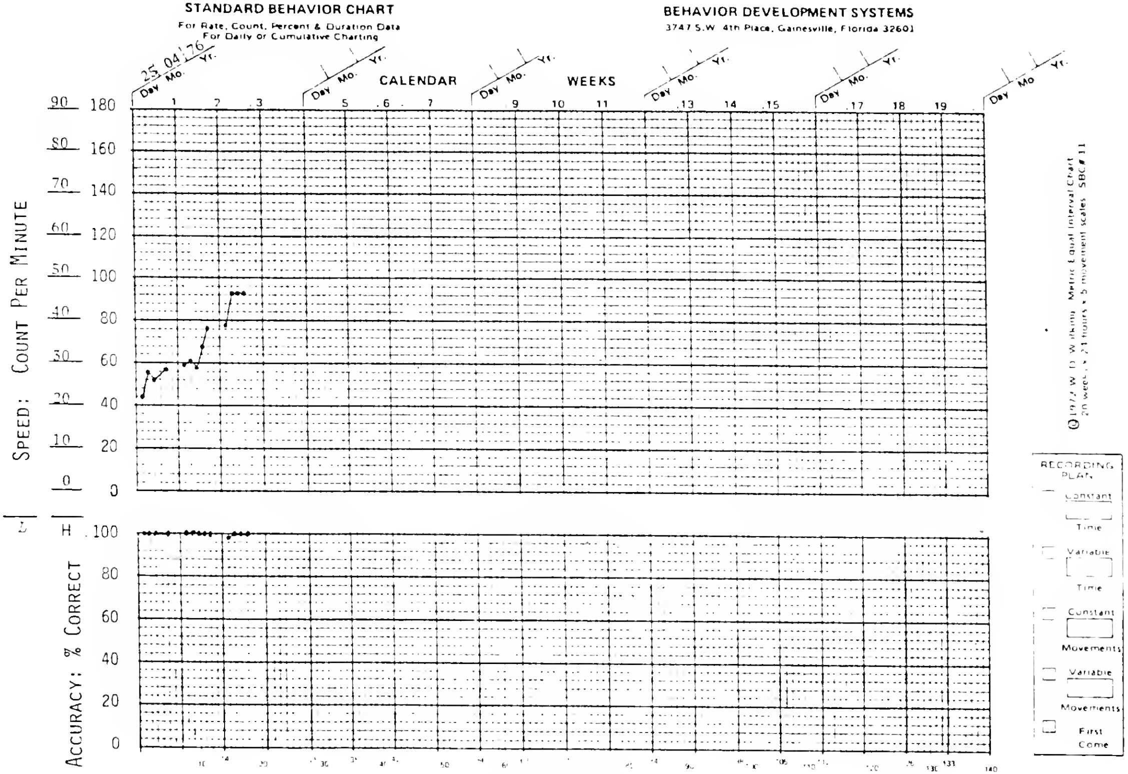


SUPERVISOR Roberta Rubin
ADVISOR
MANAGER
COUNTER Subject 29-RSR

BEHAVER Subject 29-RSR
AGE 10 GRADE 5
SCHOOL P.K. Yonge Lab.
TEACHER Jerry Hill
NOTES

PROJECT BEHAVIOR
COUNT WHEN Sees numbers - writes symbols
COUNT WHEN

Figure B-26. SPEED AND ACCURACY SUMMARY CHART FOR SUBJECT 29-RSR.



PROJECT TEAM

SUPERVISOR Roberta Rubin
ADVISOR
MANAGER
COUNTER Subject 30-RSR

BEHAVER Subject 30-RSR
AGE 10 GRADE 4
SCHOOL P.K. Yonge Lab.
TEACHER Barry Gottlieb
NOTES

MOVEMENT CYCLE

PROJECT BEHAVIOR
COUNT WHEN [-] [ ] Sees numbers - writes symbols
COUNT WHEN [x] [ ]

1500 1175-2210/C

Figure B-27. SPEED AND ACCURACY SUMMARY CHART FOR SUBJECT 30-RSR.

APPENDIX C

DATA ANALYSES FOR THE FIRST EIGHT DAYS OF THE EXPERIMENT

Table C-1

ANALYSIS OF VARIANCE SUMMARY TABLE FOR AVERAGE DAILY GAIN SCORES FOR THE FIRST EIGHT DAYS OF DATA

Source	Degrees of Freedom	Sum of Squares	Mean Squares	F
Between Groups	2	45.0205	22.5103	8.585*
Within Groups	27	70.7957	2.6221	
Total	29	115.8162		

* $p < .05$

Table C-2

MEANS AND STANDARD DEVIATIONS FOR C GROUP, SBC GROUP, AND RSR GROUP FOR AVERAGE DAILY GAIN SCORES FOR THE FIRST EIGHT DAYS OF DATA

Group	Count	Mean	Standard deviation
C	10	2.7857	1.6353
SBC	10	5.7500	1.7728
RSR	10	3.8643	1.4314
Total	30	4.1333	1.9984

Table C-3

TUKEY'S HONESTLY SIGNIFICANT DIFFERENCE PROCEDURE FOR C GROUP, SBC GROUP, AND RSR GROUP FOR THE FIRST EIGHT DAYS OF DATA

	Difference among means		
Group Means	C group	SBC group	RSR group
C = 2.7857	---	2.9643*	1.0786
SBC = 5.7500		---	1.8857*
RSR = 3.8643			---

* $p < .05$

APPENDIX D

QUESTIONNAIRE

QUESTIONNAIRE GIVEN TO C GROUP

NAME_______________________

Please circle your answer.

1. How interesting do you think the coding task is after taking it everyday?

1	2	3	4	5
Very Interesting	Slightly Interesting	Average	Slightly Boring	Very Boring

2. Did you dislike not having any type of graph or paper to see how you did for the day?

1	2	3	4	5
Dislike		Not Sure		Like

3. Do you think you would have done better if you charted or recorded your score and saw your progress everyday?

1	2
Yes	No

4. Did the quarters make you want to come each day?

1	2
Yes	No

5. What did you like best about the research project?

6. What did you like least about the research project?

QUESTIONNAIRE GIVEN TO SBC GROUP

NAME________________________

Please circle your answer.

1. How interesting do you think the coding task is after taking it everyday?

1	2	3	4	5
Very Interesting	Slightly Interesting	Average	Slightly Boring	Very Boring

2. What do you think helped you do better on the task?

   1. Charting score on chart.
   2. Seeing score on white page
   3. Seeing how many boxes you completed on the task before it was collected.

3. How helpful is the chart?

1	2	3	4	5
Helpful		Average		Not Helpful

4. How hard is it to learn how to use the chart?

1	2	3	4	5
Hard		Average		Not Hard

5. Do you think that charting your score and looking at the chart made you want to improve your score each day?

1	2
Yes	No

6. Did the quarters make you want to come each day?

1	2
Yes	No

7. What did you like best about the research project?

8. What did you like least about the research project?

QUESTIONNAIRE GIVEN TO RSR GROUP

NAME______________________

Please circle your answer.

1. How interesting do you think the coding task is after taking it everyday?

1	2	3	4	5
Very Interesting	Slightly Interesting	Average	Slightly Boring	Very Boring

2. What do you think helped you do better on the task?

    1. Putting score on Raw Score Record Form.
    2. Seeing score on white page.
    3. Seeing how many boxes you completed on the task before we collected the task.

3. How helpful is the Raw Score Record Form?

1	2	3	4	5
Helpful		Average		Not Helpful

4. Do you think that putting your score on the Raw Score Record Sheet and looking at the Raw Score Record Sheet made you want to improve your score each day?

1	2
Yes	No

5. Did the quarters make you want to come each day?

1	2
Yes	No

6. What did you like best about the research project?

7. What did you like least about the research project?

APPENDIX E

RESULTS OF THE QUESTIONNAIRE

Table E-1

TABULATED RESULTS OF THE QUESTIONNAIRE GIVEN TO THE C GROUP

Question Number	Question choices[a]				
	1	2	3	4	5
1	0	30	40	20	10
2	40	10	50	0	0
3	50	50	--	--	--
4	90	10	--	--	--

Note. Ten students answered this questionnaire.

[a] Numbers indicate percentage of responses to each choice.

Table E-2

TABULATED RESULTS OF THE QUESTIONNAIRE GIVEN TO THE SBC GROUP

Question Number	Question choices[a]				
	1	2	3	4	5
1	60	10	10	10	10
2	0	10	90	--	--
3	40	10	30	20	0
4	10	0	20	0	70
5	100	0	--	--	--
6	70	30	--	--	--

Note. Ten students answered this questionnaire.

[a] Numbers indicate percentage of responses to each choice.

Table E-3

TABULATED RESULTS OF THE QUESTIONNAIRE
GIVEN TO THE RSR GROUP

Question Number	Question choices[a]				
	1	2	3	4	5
1	50.0	50.0	0.0	0.0	0.0
2	12.5	25.0	62.5	---	---
3	62.5	0.0	37.5	0.0	0.0
4	100.0	0.0	----	---	---
5	87.5	12.5	----	---	---

Note. Eight students answered this questionnaire.

[a] Numbers indicate percentage of responses to each choice.

Table E-4

SAMPLE SUBJECTIVE RESPONSES GIVEN ON THE QUESTIONNAIRE BY THE C, SBC, AND RSR GROUPS

Questions	
What did you like best about the research project?	What did you like least about the research project?
CON Group	
1. Coding	1. It's a little boring
2. Quarters	2. Nothing
SBC Group	
1. Getting all the responses on the paper	1. That sometimes I got lower than before
2. Sometimes doing better than I did yesterday and that made me happy	2. Quarters
3. Writing signs	3. Not a thing
4. Coding task	4. That I would never finish the task
5. It was fun	
6. That each day I would want to get better	
RSR Group	
1. Seeing how good I do it	1. Doing task in a room full of people
2. The coding	2. Nothing
3. Timing and scores	3. Not getting quarters every day
4. Everything	
5. Quarters	

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Roberta Iris Rubin was born on September 22, 1951, in Brooklyn, New York. After living in New York for thirteen years, she moved to Miami, Florida, where she graduated from Southwest Miami High School in June of 1969.

She attended the University of Florida and received the Bachelor of Arts degree with honors in June, 1973, with a major in Psychology. During the summer of 1973, she began her graduate studies in the College of Education at the University of Florida. In August, 1974, she received the degree of Master of Education with a major in the Psychological Foundations of Education. Upon receiving her Master's degree, she continued her graduate studies in the area of educational psychology. During her graduate studies she held a graduate research assistantship for Project Follow Through at the Institute for Development of Human Resources.

Roberta Iris Rubin is a member of the American Psychological Association, American Educational Research Association, and of the honor societies of Phi Kappa Phi, Pi Lambda Theta, and Kappa Delta Pi.

She is presently married to Samuel Mark Streit.

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

Barry J. Guinagh, Chairman
Associate Professor of
Foundations of Education

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

Donald L. Avila
Professor of Foundations of
Education

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

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This dissertation was submitted to the Graduate Faculty of the College of Education and to the Graduate Council, and was accepted as partial fulfillment of the requirements for the degree of Doctor of Philosophy.

December, 1976

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